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ERRATA

Page	40	line 12	for '811'	read '311'
	76	15	„ 'Vong (W. G.)'	„ 'Wang (G. V.)'
	91	lines 46 and 47	for 'does not attack'	read 'attacks'
	109	last line	for '24'	read '34'
	114	last line	for '*T. agrarium*'	„ '(?) *Medicago lupulina*'
	161	line 42	for '*L. beckii, Chionaspis*'	„ '*L. beckii* and *Chionaspis*'
	164	23	„ 'A'	„ '*Agropyron*'
	169	39	„ '*distochya*'	„ '*distachya*'
	205	22	„ '*tabaci*'	„ '*tabacum*'
	208	18	„ '668'	„ '688'
	215	8	„ '*trabae*'	„ '*trabea*'
	238	22	„ 'Wellhausen (F. J.)'	„ 'Wellhausen (E. J.)'
	278	38	„ '*Althyrium*'	„ '*Athyrium*'
	284	3	„ 'Coop'	„ 'Copp'
	285	1	„ 'Fourmont (P.)'	„ 'Fourmont (R.)'
	287	13	insert 'reaction to' before 'bean'	
	311	33	for '*hesperedica*'	read '*hesperidica*'
	325	44	„ '*sclerotiorum*'	„ '*trifoliorum*'
	369	6	„ '*phaseoli*'	„ '*medicaginis* var. *phaseolicola*'
	416	8	„ 'xlvii'	„ 'xcvii'
	442	13	„ '*ircanum*'	„ '*incanum*'
	452	29	„ 'xvi'	„ 'xxvi'
	471	19	„ 'cystalline'	„ 'crystalline'
	492	lines 47 and 48	for '*platanicola*'	„ '*platanifolia*'
	507	line 6	for '*humulis*'	„ '*humilis*'
	536	38	„ 'Slink-Mezencevová'	„ 'Slinko-Mezencevová'
	560	39	„ 'New Hampshire'	„ 'England'
	565	1	„ '*paucispora*'	„ '*paucispinosa*'
	572	16	„ '16'	„ '160'
	588	17	„ '*apii*'	„ '*apii-graveolentis*'
	634	18	„ 'two first-named'	„ 'same'
	676	16	„ '*rosae*'	„ '*rosea*'
	715	40	„ '*cardinalis*'	„ '*cardinale*'
	740	16	„ 'Elliot'	„ 'Elliott'
	755	lines 25 and 26	for 'calcium chloride'	read 'chloride of lime'
	797	line 47	for 'Milbraith'	read 'Milbrath'
	798	33	„ '*diagremontiana*'	„ '*daigremontiana*'
	824	16	„ 'hosts'	„ 'host'

IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
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LEACH (J. G.), ORR (L. W.), & CHRISTENSEN (C.). **Further studies on the interrelationship of insects and fungi in the deterioration of felled Norway Pine logs.**—*J. agric. Res.*, lv, 2, pp. 129–140, 6 figs., 2 graphs, 1937.

The results of experiments started in May, 1931, and terminated in September, 1934, which were conducted on lines similar to those described in a previous paper by the authors [*R.A.M.*, xiv, p. 137], showed that by the end of the third year after felling the entire sapwood and a considerable portion of the heartwood of Norway pine (*Pinus resinosa*) logs were decayed, when the logs were left fully exposed to environmental conditions. The primary cause of the decay of both sap- and heartwood was found to be *Peniophora gigantea* [ibid., xiv, p. 270], which is apparently readily disseminated by wind and may enter the logs through cracks in the bark or through holes made by several species of insects. No evidence, however, was obtained indicating that this fungus is dependent on insects to enable it to infect the logs, but the fact that a fair degree of correlation was established between the number of Cerambycid beetles (*Monochamus scutellatus* and *M. notatus*) in the logs and the amount of heartwood decayed suggests that the larvae of these insects hasten the decay by facilitating the radial and tangential invasion of the heartwood by *P. gigantea*. The other species of insects living inside the logs or inhabiting the bark and outer layers of the sapwood appear to have little influence on wood decay.

FINDLAY (W. P. K.) & PETTIFOR (C.B.). **The effect of sap-stain on the properties of timber. I. Effect of sap-stain on the strength of Scots Pine sapwood.**—*Forestry*, xi, 1, pp. 40–52, 1937.

This is a full account of the experiments to test the effect of *Ceratostomella coerulea* (*Ophiostoma coeruleum*) on the mechanical properties of the sapwood of Scots pine (*Pinus sylvestris*), a preliminary report of which has been noticed from another source [*R.A.M.*, xv, p. 185]. The results showed that the presence of *C. coerulea* and of another blue-staining, as yet unidentified fungus (S 51), isolated from heavily stained sapwood of slash pine (*P. caribaea*), had no appreciable effect on the compressive or the bending strength of the wood, but that it caused a marked reduction in toughness (measured as the energy absorbed in fracturing a test piece at a single blow) and a slight reduction in hardness. The effect on toughness was much greater in timber that had been first steamed at 100° C. for 90 minutes, in one case this

reduction being as high as 40 per cent. of the values for unstained controls, while the highest reduction in unsteamed stained timber was only 30 per cent. From a practical standpoint, it is stated that blue stain is deleterious only when timber of exceptional toughness is required, but blue-stained sapwood should never be used for purposes requiring a high resistance of the timber to suddenly applied loads.

JONES (A. W.). **Wood preservation.**—*Min. Mag., Lond.* lvii, 1, pp. 19–28, 2 figs., 3 diag., 1937.

The characteristics of various wood preservatives are described with special reference to conditions in mines [*R.A.M.*, xvi, p. 788]. Neither brushing nor steeping is a wholly effective method of application, but the open-tank treatment gives very satisfactory results if properly applied with heating to 175° to 180° F. Pressure impregnation, however, is the most reliable method of applying creosote, outlines are given of the Burnettizing (full cell), Rueping, and Lowry (both partial cell) processes [ibid., xii, p. 670· xiv, p. 545, *et passim*], the time occupied by the first named being estimated at 7¼ hours, while the two others each take 4 hours 20 minutes. Changes in either vacuum or pressure must always be very gradually made, or the cell walls, particularly of the softwoods may be broken down; internal temperatures should never exceed 240°. When zinc chloride is used the solutions should be frequently tested for hydrochloric acid (which decreases the strength of the wood) and for basic zinc chloride (reducing the strength of the preservative). Operating procedure is described in some detail, supplemented by the plan of a small pressure plant. The estimated costs per cu. ft. of 5 per cent. zinc chloride, 5 per cent. Wolman salts, and creosote (10 lb. per cu. ft.) are 2*s.* 7*d.*, 6*s.* 0*d.*, and 7*s.* 5*d.*, respectively.

FINDLAY (W. P. K.). **Decay of structural timber in cold stores.**—*Proc. Brit. Ass. Refrig.*, xxxii (*1936–37*), pp. 49–54, 1937.

In the course of a popular account (followed by a discussion, pp. 55–61) of the conditions favouring activity of wood-destroying fungi in cold stores, chiefly *Merulius lacrymans*, *Poria vaporaria*, and *Coniophora cerebella* [*C. puteana*: *R.A.M.*, xvi, p. 789], and the possibilities of their control, the writer advocates treatment of the timber with sodium fluoride (6 oz. per gall. water), a coating of aluminium paint, and the use of baked cork slabs for insulating purposes. Wood actually invaded by *M. lacrymans* or *P. vaporaria* should be excised for 12 to 18 in. beyond the last visible signs of attack, while exposed brickwork should be sterilized with a blowlamp flame or by antiseptic treatment, the remaining sound timber and any new wood used for replacements also being thoroughly disinfected. In the case of *C. puteana* only the diseased parts need be cut out.

CARTWRIGHT (K. St. G.). **The causes of stain and decay in imported timber.**—*Dep. sci. indus. Res. For. Prod. Res. Rec.* (*Mycol. Ser.* 2), 18, 15 pp., 7 pl., 2 figs., 1937.

In this paper the author distinguishes two main causes of the discoloration of imported timber at the port of entry: (1) chemical, (2) biological, e.g., sap-staining organisms, moulds, and wood-decaying fungi.

Chemical stains are more or less superficial, usually distributed in spots or irregular blotches bearing no relation to the grain of the wood, and may be rust-red, black, blue, or grey.

Staining is distinguished from decay by being mostly confined to the sapwood, causing blue, blue-grey, or green, or occasionally pink or yellow discoloration with no appreciable weakening of the timber. Dote, often loosely used as an alternative to decay, is defined as localized patches or pipes of incipient decay.

Fungi do not develop appreciably in timber of 20 per cent. moisture or less, and growth is slow when it is below 30 per cent. The higher the temperature up to about 80° F. the more rapid will be the development of the fungi, provided sufficient moisture is present; below 40° growth is usually slow, and none occurs below about 35°. Deep penetration of stain indicates that the sapwood has remained moist for a long time, and suggests that the timber was moist when shipped. Where stain or active mould growth is confined to the surface it definitely indicates the presence of surface moisture, due either to moisture movements from the interior of imperfectly seasoned timber, to water moistening the exterior, or a combination of both. If the mould growth is dry and the moisture content reasonably low, the timber was probably exposed before shipment to rewetting. Deep-seated stain, fairly uniform in distribution, almost invariably suggests that the unseasoned timber was close piled for at least two or three weeks. Spotting often results from rain or drip on seasoned timber. Extraneous internal decay indicates infection in the standing tree and rot that is confined to the sapwood points to infection after felling.

The paper concludes with recommendations for control by drying the timber to a moisture content of under 20 per cent. and protecting it from further wetting, or by dipping in an antiseptic immediately after conversion.

Boller (E. R.). **Preservative treatment of green southern Yellow-Pine timber with zinc chloride and zinc chloride-sodium bichromate.**— *Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 262–278, 3 graphs, 1937.

Green southern yellow pine [*Pinus palustris* and other species] timber was shown to be capable of satisfactory impregnation with zinc chloride-sodium bichromate (5 : 1) [*R.A.M.*, xvi, p. 79] or the former alone by conditioning with either steam or water at 260° F., subjecting to vacuum and pressure, and treating with a 5 per cent. solution of the preservative at 165°. The time required for the process may be curtailed by conditioning the wood with the solution at 260°, subjecting to vacuum and pressure, and then treating with a 5 per cent. solution of the preservative at 220° to 260°. A fairly satisfactory treatment with zinc chloride can also be made, omitting the application of vacuum following conditioning. The moisture content of the treated wood can be appreciably reduced by the application of a final vacuum. In general, treatment reduced the moisture content of the green pine when the initial humidity was high, but raised it when the initial content was relatively low. Some indication was given that the treatment would minimize deterioration of the pine when kiln-dried under unfavourable conditions.

CHIDESTER (MAE S.). **Temperatures necessary to kill fungi in wood.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 316–324, 2 diags., 1 graph, 1937.

The results of experiments in the exposure of sapwood sticks of loblolly pine (*Pinus taeda*) inoculated with *Poria incrassata*, *Lenzites sepiaria*, and *Lentinus lepideus* in test-tubes to temperatures ranging from 149° to 212° F. for varying periods indicated that all three fungi succumb after an hour at 150°, half an hour at 170°, 20 minutes at 180°, 10 at 200°, or 5 at 212°, provided the moisture content of the wood remains above fibre saturation point. These data apply to material heated in steam or hot oil. Higher temperatures or longer periods of exposure are probably necessary to kill the organisms in wood heated in air with 35 to 40 per cent. relative humidity.

KAUFERT (F.) & SCHMITZ (H.). **Studies in wood decay. VI. The effect of arsenic, zinc, and copper on the rate of decay of wood by certain wood-destroying fungi.**—*Phytopathology*, xxvii, 7, pp. 780–788, 1 graph, 1937.

The addition of low concentrations of arsenic trioxide [*R.A.M.*, xvi, p. 649] to Norway pine [*Pinus resinosa*] sawdust was shown definitely to stimulate its decay by *Lenzites trabea* and *Lentinus lepideus*, while even the lowest concentration used (50 p.p.m.) was toxic to *Trametes serialis* and *Polyporus anceps*. *L. lepideus* and *Lenzites trabea* were incited to more extensive rotting of the sawdust by the addition of zinc chloride at concentrations of 100 to 400 p.p.m., whereas above the latter strength this compound was apparently toxic to both fungi. *Lentinus lepideus* seems to be considerably more resistant to copper sulphate than *Lenzites trabea*, while the relationship is reversed in the case of arsenic trioxide; the experiments with the former compound, however, gave somewhat inconclusive results.

SCHMITZ (H.), SCHRENK (H. v.), & KAMMERER (L.). **The quality and toxicity of coal-tar creosote extracted from Red Oak ties after long periods of service, with special reference to the decay resistance of treated wood.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 35–90, 1 fig., 11 diags., 4 graphs, 1937.

From the results [which are fully discussed and tabulated] of an exhaustive inquiry into the quality of the extracted creosotes and a study of decay resistance, under conditions conducive to the growth of the wood-destroying fungi, *Fomes annosus* [see next abstract], *Lentinus lepideus*, and *Trametes serialis*, of the wood of two red oak [*Quercus rubra*] sleepers after comparatively lengthy service periods (No. 246 having been laid down in 1918 and No. 247 in 1923), the following conclusions are reached. Changes occur during the service period in the specific gravities, distilling ranges, and physical characteristics of the creosotes, especially in the outer layers of the treated wood. Wide variations in the toxicity of the extracts from different zones of the wood were also registered, but these appear to be of little practical significance, the treated material from all parts of both sleepers (of which 246 was impregnated with a heavy creosote and 247 with a light one) being decay-resistant even after ten months' exposure to

actively growing wood-destroying fungi. Observations on the movement of the creosote constituents in the wood denote that in all probability the creosote in the interior of the sleeper serves as a reservoir whence the outer layers are supplied; hence the larger the amount of creosote originally injected, the longer will this feeding process continue and the expectation of durability will be correspondingly increased. It is apparent from these data that the initial toxicity of creosote and other coal-tar products cannot be taken as a guide to the ultimate value of the preservative, and no method is known to the writers whereby the above-mentioned gradual changes in toxicity in different zones of the treated wood during the service period could have been predicted or evaluated at the time of impregnation.

RICHARDS (C. AUDREY). **The doubtful identity of fungus No. 517.**—*Proc. Amer. Wood Pres. Ass.*, xxxiii, pp. 104–106, 1937.

A comparison has recently been made of culture No. 517 of the Madison (Wisconsin) branch of the Division of Forest Pathology, which was isolated by C. J. Humphrey from a sporophore, ostensibly of *Fomes annosus* [*R.A.M.*, xvi, p. 290], from mine timber in 1910 and has since been consistently used in timber preservation tests, with *Polyporus tulipiferus* No. 691 [loc. cit.] and typical *F. annosus* cultures. Both 517 and *P. tulipiferus* differ from typical *F. annosus* cultures in the production of cystidia and in their larger basidiospores, as well as in their rapid growth at 35° C., at which temperature the development of *F. annosus* proper is entirely inhibited [ibid., xiii, p. 413]. In the absence of sporophores 517 cannot be definitely identified, and it is suggested that it should be temporarily referred to by its number in order to avoid possible confusion with the type species, now widely used throughout the world in the toximetric determination of wood preservatives.

OGILVIE (L.) & HICKMAN (C. J.). **Progress report on vegetable diseases. VIII.**—*Rep. agric. hort. Res. Sta. Bristol, 1936*, pp. 139–148 [1937].

Owing to the cool, moist conditions prevailing during the summer, anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xiv, pp. 670, 734; xvi, p. 660] became very prevalent on dwarf beans [*Phaseolus vulgaris*] in 1936 at Long Ashton, though the Princess and Hundred for One varieties remained unaffected, and Lightning, Unrivalled, and Best of All were only slightly attacked. Mosaic [ibid., xvi, p. 439] was somewhat widespread, the symptoms being most conspicuous on the Emperor William and Keeney's Stringless Refugee varieties, of which the latter is now commonly grown for canning in England. Foot rot (*Fusarium solani* var. *martii*) [ibid., xiv, p. 730] of dwarf beans was again prevalent in Worcestershire. Runner beans at Offenham, Worcestershire, showed sporadic infection of the bases of subsidiary branches (which wilted and collapsed) by a species of *Sclerotinia*.

Early cauliflowers growing at Mickleton, Gloucestershire, were seriously affected in July, 1936, by a condition which had affected 75 per cent. of a crop of cauliflowers and Savoy cabbages at Ross-on-Wye in 1933. In addition to the deformed, strap-like leaves noted in the earlier occurrence, the affected plants at Mickleton showed leaves

present in the curd; the condition occurred in fairly well-defined areas, as it had previously. The symptoms resemble those of 'whiptail' [ibid., xiii, p. 344] attributed to lime deficiency; soil samples from Ross showed 0·098 per cent. exchangeable calcium oxide and a P_H value of 4·99, while two others from affected areas at Mickleton showed 0·762 and 0·859 exchangeable calcium oxide and free calcium carbonate in both.

In a summer trial of 89 lettuce varieties occasional cases of 'drop', due to *Sclerotinia sclerotiorum* [*R.A.M.*, xvi, p. 797] and possibly other species were noted. Mosaic [ibid., xv, p. 763] was present only to a very slight extent, probably because the severe winter had reduced the number of aphids. Some of the plants showed a condition suggestive of 'big vein' [ibid., xiv, p. 283], which had been noticed previously in the vicinity. All the summer varieties showed severe leaf infection by *Botrytis* [*cinerea*: ibid., xv, p. 196], and most of the seeds gathered were heavily infected in the cotyledons with mycelium which was still viable after two months; when the seeds were sown patches of the fungus were produced in the soil and served as infection centres for the healthy seedlings. One commercial sample of lettuce [seed] contained infected seeds.

Immersion of mint [*Mentha villoso-nervata*] runners in water at 105° to 115° F. for ten minutes during mid-February, when observations indicated that the mycelium of *Puccinia menthae* [ibid., xv, p. 763] was present in the shoots, completely controlled the disease.

During July large patches of peas in one locality in Wiltshire died off as a result of infection of the stem bases by *Pythium ultimum*.

Dowson (W. J.) & Dillon Weston (W. A. R.). **Soft rot of Broccoli.**—*Gdnrs' Chron.*, cii, 2636, p. 14, 1937.

During the spring of 1937 broccoli plants at the University Farm, Cambridge, and elsewhere, were severely attacked by *Bacterium carotovorum* [*Erwinia carotovora*], which induced a soft, dark, malodorous decay of the curds. The organism had probably been splashed from the soil on to the plants by the heavy rains in the early part of the year.

Tompkins (C. M.). **A transmissible mosaic disease of Cauliflower.**—*J. agric. Res.*, lv, 1, pp. 33–46, 5 figs., 1937.

This is a full account of the author's investigations on the virus disease of cauliflowers in California, a preliminary report of which has already been noticed from another source [*R.A.M.*, xiv, p. 207]. The first symptom of the disease, both in natural and artificial infection, is a clearing of the veins, usually beginning at or near the base of the leaf; this condition may persist for 10 to 20 days, but gradually changes to veinbanding, consisting of narrow, continuous, dark green areas parallel with and adjoining the midrib and lateral veins, which with dark green interveinal islands give the leaf a mottled aspect. Later small, irregular, light tan necrotic lesions occur in the mottled areas, often accompanied by curvature of the midrib and leaf distortion. Early infection usually results in severe stunting of the plants, but even in the absence of stunting diseased cauliflowers are not desirable for shipment because of the bleaching or yellowing of the mottled leaves in transit. Under greenhouse conditions, the symptoms developed well

at temperatures between 10° and 19° C., but became masked at higher temperatures. As determined by H. H. P. Severin, transmission of the disease in the field is effected by *Brevicoryne brassicae*, *Rhopalosiphum pseudobrassicae*, and *Myzus persicae*, and the virus was shown to be also transmissible by artificial juice inoculation with carborundum as abrasive. The virus withstands ageing *in vitro* for 14 to 15 days, is inactivated at approximately 75°, and tolerates about 1 in 2,000 dilution. Its host range includes 51 vegetable varieties, 3 ornamentals, and 5 weeds, all belonging to the Cruciferae.

Giddings (N. J.). **A greenhouse method for testing resistance to curly top in Sugar Beets.**—*Phytopathology*, xxvii, 7, pp. 773–779, 2 figs., 3 graphs, 1937.

The following is the writer's method of testing selected strains of sugar beet for resistance to curly top in the greenhouse [*R.A.M.*, xvi, p. 650]. The plants are grown in boxes, $22\frac{1}{4}$ by $5\frac{1}{2}$ by $4\frac{3}{4}$ or $6\frac{3}{4}$ in., usually six pairs per box, and the inoculations are generally made on seedlings in the two true-leaf stage five to eight days after transplanting. One viruliferous beet leafhopper [*Eutettix tenellus*] is used per plant and allowed to remain for a week. Notes are taken at the end of the inoculation period, at three- or four-day intervals for about a fortnight, and then at weekly intervals for five or six weeks. An ascending scale of five grades is used for rating the degree of severity. In a series of comparisons between the U.S. 1 variety and a number of susceptible strains, 65 per cent. of the former and 78 per cent. of the latter became infected, the corresponding average severity of the attacks being 3·3 and 4·3 per cent. respectively. The average incubation period for U.S. 1 was 10·1 days, and for a susceptible strain, 2705–24, 8·6 days. Of the diseased U.S. 1 plants, 0 to 10 per cent. died during the tests, the corresponding figures for 2705–24 being 10 to 49 per cent. The results secured by this method appear to be comparable to those obtained in the field.

Davis (G. N.) & Henderson (W. J.). **The interrelation of the pathogenicity of a Phoma and a Fusarium on Onions.**—*Phytopathology*, xxvii, 7, pp. 763–772, 4 figs., 2 graphs, 1937.

Combined attacks of pink root (*Phoma terrestris*) and bulb rot (*Fusarium* [*vasinfectum* var.] *zonatum* f. 1) of onions [*R.A.M.*, xvi, p. 440] has caused the temporary abandonment of some 200 acres of valuable land under this crop in Iowa. *P. terrestris* is responsible for heavy seedling losses in infested fields, and may attack the roots at any time during the growing season, while *F.* [*vasinfectum* var.] *zonatum* f. 1 causes a semi-dry rot of bulbs both in the field and in storage, but does not invade the bulbs or roots except following injury or infection by another pathogen. Both fungi have the same optimum temperature (28° C.) and grow well over a P_H range of 3·8 to 7·6, with an apparent peak at 5·4 to 5·8, but *F.* [*vasinfectum* var.] *zonatum* f. 1 seems to be more sharply limited than *P. terrestris* on the alkaline side of the scale. Neither disease is amenable to control by soil or seed treatment, but by means of selection and inbreeding five strains of Red and Yellow Globe onions have been isolated which sustained less than 5 per cent.

loss from bulb rot in the field and in storage during 1935–6, when the damage to the checks amounted to 90 per cent. Little progress has yet been made, however, in the development of resistance to pink root.

Passalacqua (T.). **Una probabile virosi della 'Vicia faba L.' (Nota preliminare).** [A probable virosis of *Vicia faba L.* (Preliminary note).]—*Riv. Pat. veg.*, xxvii, 5–6, pp. 145–148, 1 fig., 1937.

Broad beans (*Vicia faba*) growing near Palermo were affected by a disease characterized by a conspicuous dwarfing of the plants, shortening of the internodes, and flattening of the stem, which remained unbranched at the base. The leaves dried up from the margins inwards, and turned tobacco-colour. Very few flowers were formed and the fruits remained small and wilted. No causal organism was isolated, and the author considers that the condition, which resembles in some respects court-noué of the vine or drought effects, was probably due to the action of a virus.

Nelson (R.), Coons (G. H.), & Cochran (L. C.). **The Fusarium yellows disease of Celery (Apium graveolens L. var. dulce DC.).**—*Tech. Bull. Mich. agric. Exp. Sta.* 155, 74 pp., 18 pl. (1 col.), 1937.

Two forms of *Fusarium* yellows of celery occur generally in the Michigan celery districts [*R.A.M.*, xiv, p. 418; xvi, p. 158]. Form I causes retardation of the growth rate and dwarfing, followed by a fading of the colour of the older leaves due to small flecks of chlorotic tissue that appear in the interveinal areas, sometimes localized at the edge of the leaflet. Under favourable temperature conditions a definite mottle appears. Later, the green disappears from the lamina, but the veins remain pale green, and subsequently the whole leaflet approaches a uniform straw-yellow and finally cream, wilting occasionally setting in before this stage is reached. The vascular tissues are brown or red from the ends of the invaded fibrous roots to the crown or even the leaflets. The crown tissue may be extensively decayed. The leaves frequently become brittle, especially in the green varieties, in which this symptom and dwarfing may be the only apparent evidence of infection. Root rot is commonly present. The leaves and petioles develop an intensely bitter flavour, and the roots and crowns when cut open emit a characteristic pungent odour. Adventitious buds are stimulated to develop, the supernumerary petioles being frequently twisted and intertwined, while the petioles are sometimes split vertically near the base; two or more crowns may be present. In fatal cases a gradual or sudden wilt is the final stage.

In form II the first symptom is a downward curling of the youngest heart leaves, curling not being so pronounced in the older leaflets until after chlorosis has set in. Decolorization always appears first in the veins, which turn straw-yellow and, later, cream. Narrow bands of tissue on either side of the blanched veins next become decolorized, the arrangement of the green and yellow pattern being the exact opposite of that in a leaf of the same stage of development affected with form I. The whole leaflet finally turns a cream colour. The heart leaves remain green until the last stage of the disease. The Californian form of yellows appears to differ from forms I and II, but it is not yet

proved definitely to be distinct. Each of the Michigan forms was shown to be due to a different pathogen, that causing form I being named *F. apii* Nelson & Sherb. n. sp. (syn. *F. apii* Nelson & Cochran *nomen nudum* [ibid., xiv, p. 419], *F. orthoceras* var. *apii* Wr & Reinking), and that causing form II *F. apii* var. *pallidum* Nelson & Sherb. n. var. (syn. *F. apii* var. *pallidum* Nelson & Cochran *nomen nudum* [loc. cit.] and *F. orthoceras* var. *apii* f. 1 Wr & Reinking), each with a Latin diagnosis.

The organisms showed only slight morphological differences, but different colour reactions and responses to toxic substances in the medium. *F. apii* occasionally produced conidia in discrete, creamy pionnotes, the conidial measurements ranging from an average of 10 by 3·4 μ (0-septate) to one of 46·7 by 4·8 μ (5-septate, very rare), though typically these organs were 3-septate and averaged 39 by 4·3 (mostly 34·5 to 40·7 by 3·9 to 4·5) μ. The terminal, intercalary or intraconidial, subglobose to piriform, smooth chlamydospores, occurring singly or in chains of two, measured 8·6 by 7·9 μ. *F. apii* var. *pallidum* n. var. showed 0- to 6-septate conidia produced singly or in false heads and averaging, respectively, 10 by 3·4 μ and 56·7 by 4·5 μ, though typically these organs were 3-septate and averaged 39·3 by 4·3 (mostly 34·5 to 40·7 by 3·9 to 4·7) μ. The chlamydospores measured 8·5 by 8·1 μ, and the rare sclerotia were blue. The optimum growth temperature for the two organisms was, respectively, 28° to 29° and 26° to 28° C. Celery grew best at a soil temperature of 20° and the disease was most active at 26° to 30° soil temperature.

Control methods recommended consist in the exclusion of the pathogens from non-infested soils by steaming, improved cultural practices, and the use of resistant varieties such as Golden Self-Blanching, Curly Leaf Easy-Blanching, and Michigan Golden.

Brown (W.). **A study of the deterioration of Seakale stocks, with notes on some diseases of that crop.**—*J. Pomol.*, xv, 2, pp. 69–85, 1 pl., 1 diag., 1937.

Sea-kale (*Crambe maritima*), a high-priced vegetable crop grown in the vicinity of London, suffers from a deterioration of forcing qualities, in which nearly all the terminal buds of the crown of the root cuttings used for forcing remain dormant, whilst numerous small side buds sprout and give rise to thin, 'grassy' sea-kale of no commercial value. Details are given of investigations at Slough, started in 1931, the results of which indicated that the deterioration is mainly due to the usual presence in the stocks of a number of plants which do not force well but are strong growers, particularly in the spring, so that their number gradually tends to increase owing to the propagation methods in practice; manurial treatment, on the other hand, is only a factor of secondary importance in this respect, but fungal or virus diseases may also be a contributory factor. The history of a number of clones of both types is recorded and none of the good clones has shown any significant deterioration after 4 or 5 seasons. Roguing on the basis of leaf characters when the root system is small is recommended.

During the work it was observed that club-root [*Plasmodiophora brassicae*] may occasionally be very troublesome to the crop, but is

successfully kept in check by heavy liming of the soil. *Rhizoctonia crocorum* [*Helicobasidium purpureum*: *R.A.M.*, xv, p. 776] was met with only occasionally, more particularly on the distal parts of the roots, and very rarely interferes with the forcing of the crowns. *R.* [*Corticium*] *solani* causes a black rot of the leaf stalks in the forcing pits, and a natural disbudding of the plants in the field, occasionally resulting in the death of the whole plant. A sporadic leaf mottling was also observed, suggestive of a virus disease, but so far no evidence is at hand to support this view.

KLEBAHN (H.). **Untersuchungen über die Krankheiten des Meerrettichs. II. Bericht.** [Investigations on Horse-Radish diseases. Report II.]—*Phytopath. Z.*, x, 2, pp. 121–167, 16 figs., 1937.

Further investigations on the root blackening disease of horse-radish lately attributed by Böning to *Verticillium dahliae* [*R.A.M.*, xvi, p. 361] failed to convince the writer, as previously indicated [ibid., xiv, p. 419], of the implication of this fungus in the trouble. The blackening organism forms larger sclerotia than the minute structures typical of *V. dahliae*, imparting an almost black coloration to agar cultures, and should probably be regarded as a new species, for which the name *V. armoraciae* is proposed [without a diagnosis].

Diseased root fragments were permeated by branched, septate hyphae, 1 to 3·5 μ in diameter, with occasional spherical, hyaline or faintly tinted, sparsely echinulate conidia, 5 to 6 μ in diameter, borne singly at the tips of conidiophores 2 μ in diameter. Considerable difficulty is presented by the classification of this organism, which is tentatively designated *Zygodesmus armoraciae*. It is associated with a disintegration of the tissues into cord-like, shrivelled fragments, sometimes laterally joined, but no connexion with blackening was apparent.

A condition known as 'core rot' [ibid., xvi, p. 362] or 'hollowing' is characterized by a yellowish-brown discoloration and eventual disintegration of the xylem parenchyma, from which bacteria were isolated. Preliminary inoculation experiments resulted in the development of symptoms approximating to those observed in nature. There is some reason to suppose that 'hollowing' and 'red brittleness' [loc. cit.] may be different manifestations of the same agent, though the two disorders may be of distinct origin.

A strain of *Cystopus candidus* from horse-radish [ibid., xiv, p. 1; xvi, p. 361] was shown to be capable of attacking *Capsella bursa-pastoris*, but definite evidence of transmissibility in the reverse direction is still lacking.

Discussing the possibilities of combating these diseases, the writer insists on the primary importance of absolutely clean planting material. Crop rotation is another valuable means of control, since the pathogens of blackening, core rot, and red brittleness originate in the soil and penetrate the unavoidable wounds at the base of the cuttings, but where this is not practicable, some protective substance should be applied to the cuts. The control of *C. candidus* necessitates repeated field inspections during the spring, the burning of infected plants, and the treatment of the remainder with Bordeaux mixture.

PIZER (N. H.). **Investigations into the environment and nutrition of the cultivated Mushroom, Psalliota campestris. I. Some properties of composts in relation to the growth of the mycelium.**—*J. agric. Sci.*, xxvii, 3, pp. 349–376, 1 pl., 1937.

The investigations recorded in this paper were carried out to ascertain the properties of composts which influence the growth of *Psalliota campestris* [*R.A.M.*, xvi, p. 585] in the early stage of active development and penetration of the compost. Ten composts, each unsuitable for mushroom growing, sticky to the hand, and with a tendency to bind were used, and treated in a systematic manner so as to remove certain types of constituents in turn. After each treatment the altered compost was placed in tubes, autoclaved, and inoculated with spawn, and the resultant growth observed.

Extraction of the composts with ether and 95 per cent. alcohol did not materially affect the growth of the mycelium, whereas extraction with 70 per cent. alcohol and cold water altered the composts so that the fungus grew readily in them, though this did not invariably occur. When growth followed digestion with 70 per cent. alcohol, treatment with cold water always improved it. The effect of the cold water is to disperse and hydrate the lyophilic colloids and to remove from 7 to 9 per cent. of the organic matter and from 3 to 5 per cent. of the cork constituents, resulting in a less sticky compost capable of absorbing more water.

Three ways in which the substances removed by water and 70 per cent. alcohol may exert their toxicity are (1) by their chemical constitution, (2) by increasing the osmotic pressure, (3) by altering the dispersion of the organic material. Extraction with the two solvents may be expected to remove most of the toxic materials, and certainly all substances capable of exerting high osmotic pressure, but even so growth sometimes fails to take place. On the other hand, the idea that high dispersion of the colloidal constituents of composts is detrimental to the growth of mycelium affords a complete explanation of the results obtained. In further experiments on the effect of modifying the degree of dispersion on mycelial growth, the flocculating effect of sodium, ammonium, potassium, magnesium, and calcium ions was studied and calcium was found to be very active in producing aggregation, and the only cation to do so. The improvement brought about by absorbed calcium was outstanding and consistent, the other ions invariably causing a falling-off in growth. The correct degree of dispersion is, therefore, that given by excess of calcium ions, but there appeared to be no advantage in removing colloidal material provided it was flocculated by calcium ions. The effect of water-soluble substances in composts on mycelial growth was tested by absorbing water extracts on filter paper and inoculating the product with spawn. The results showed that there are no toxic compounds in the water extracts which have, in fact, a marked nutritive value, but that the water-soluble substances are detrimental in association with the insoluble constituents of the composts. The explanation of these facts lies in the tolerance of the mushroom mycelium to highly dispersed material, but if the latter is present in sufficient quantity growth is hindered or stopped. Other experiments

with water extracts absorbed on filter paper also indicated the significance of dispersion.

In discussing the results of his study the author emphasizes the importance of the degree of dispersion of the various constituents of the compost. Flocculation with calcium ions must result in a compost which is non-greasy, friable, and granular, but the reason why such a physicochemical change should render the compost more suitable to the fungus is not known. The obvious remedy to the grower against composts in bad condition is to add a sufficient quantity of calcium to the manure before composting is begun. Experiments [details of which await publication] with ground gypsum have shown that by the addition of this fertilizer in quantity sufficient to ensure a content of 1·5 to 2 per cent. in the finished compost, greasiness is prevented and normal growth obtained.

Bernard (G.). **L'apoplexie de la Vigne.** [Vine apoplexy.]—*Agric. prat., Paris*, N.S., ci, 31, pp. 1111–1112, 1937.

A popular account is given of the 'apoplexy' disease of the vine [*Stereum necator* or *Fomes igniarius*: *R.A.M.*, xv, p. 199; xvi, p. 436], which is stated to occur throughout Europe and in western Asia, especially Syria and Palestine, causing heavy losses annually in the south of France, Italy, and southern Greece. Excellent control is obtainable by spring or autumn applications of a mixture of 20 kg. arsenious acid, 14 kg. carbonate of soda, 18 kg. soap, and 100 l. water, diluted 20 times in water.

Casale (L.). **La necessità del risparmio del rame nella lotta antiperonosporica.** [The necessity of economizing copper in the control of Vine mildew.]—*Nuovi Ann. Agric., Roma*, xvii, 2, pp. 207–220, 1937.

The author points out that an economy in the amount of copper used in spraying vines against mildew [*Plasmopara viticola*] can be effected by incorporating substances in the spray mixture which maintain the copper in a soluble or at least readily diffusible condition so that less copper is required than in Bordeaux mixture, but more is present in an available form. Such mixtures were prepared by combining copper sulphate, copper chloride, and Caffaro powder with citric acid, sodium pyrophosphate, oxalic acid, and iron sulphate and rendered neutral by the addition of sodium hydrate or sodium carbonate.

In experiments with ten of these mixtures the largest amount of soluble copper (3·5 mg. copper per l.) after four washings of the dried residues (each at laboratory temperature and 100° C.) was given by a mixture of 200 gm. copper sulphate, 50 gm. citric acid, 5 c.c. 30 per cent. solution of ferric chloride per 100 l. with sufficient sodium hydrate to induce a neutral reaction [*R.A.M.*, xvi, p. 512], compared with a trace only for 1 per cent. Bordeaux mixture. The addition of citric acid to the mixture renders it more lasting in its effects than the latter, though containing only one-fifth as much copper. When the sodium hydrate was replaced by sodium carbonate, rapidity and duration of the action were still further improved. Further tests on a more extensive scale are to be carried out.

Plantesygdomme i Danmark 1936. Oversigt, samlet ved Statens plantepatologiske Forsøg. [Plant diseases in Denmark in 1936. Survey of data collected by the State Phytopathological Experiment Station.]—*Tidsskr. Planteavl*, xlii, 2, pp. 189–249, 12 figs., 2 graphs, 1937. [English summary.]

The following are among the items of interest in this report, prepared on the usual lines [cf. *R.A.M.*, xvi, p. 86].

Ascochyta imperfecta [ibid., xvi, p. 259] was detected on home-grown seed of *Medicago lupulina*.

With cultures of *Pseudomonas mors-prunorum* from Danish myrobalan [*Prunus divaricata*] leaves Dr. Wormald obtained positive results on the branches and stems of Victoria plums in England [ibid., xvi, p. 692]. This is believed to be the first record of the pathogen in continental Europe. One out of nine Bismarck and 5 out of 21 Cox's Pomona apples and 2 out of 25 hazel nuts [*Corylus avellana*] reacted positively to inoculations made by tying infected material of *Sclerotinia fructigena* [ibid., xvi, p. 86] from *P. divaricata* to the uninjured stalks.

Podosphaera leucotricha was very prevalent on apples [ibid., xvi, pp. 468, 756], though seldom destructive, and spraying with lime-sulphur or 1 per mille salicylic acid gave good control.

A very fair degree of resistance to potato blight (*Phytophthora infestans*) was shown by the Alpha and Gustav Adolf varieties. Wart disease (*Synchytrium endobioticum*) was reported from four new administrative areas, bringing the total at the close of 1936 to 121 [ibid., xvi, p. 56].

Bacterium [*Pseudomonas*] *tolaasi* was responsible for destructive outbreaks of disease in mushroom [*Psalliota* spp.] beds [ibid., xiv, pp. 146, 346], especially under excessively warm and damp conditions. Control measures should include maintenance of a temperature of 13° C. and disinfection of the irrigation water with 0·5 per cent. chloride of lime. Both *Myriococcum praecox* [ibid., xvi, p. 653] and *Monilia* [*Oospora*] *fimicola* [ibid., xvi, p. 726] have been more or less prominent since 1931, the former extensively infesting compost with a consequent serious reduction in the mushroom yield.

New phytopathological records for Denmark include *Pseudomonas* [*Bact.*] *medicaginis* var. *phaseolicola* on beans [*Phaseolus vulgaris*: ibid., xvi, pp. 441, 728], Masterpiece being among the varieties affected; *Septoria polygonicola* forming round or angular, sharply defined, brown spots with a paler edge on the Ruby variety of *Polygonum orientale*; *S. leucanthemi* producing circular, dark-bordered lesions on *Chrysanthemum maximum* leaves [ibid., x, p. 553]; *Ceratophorum setosum* on lupin (*Lupinus polyphyllus*) foliage [ibid., xvi, p. 655]; an *Alternaria* with 8- to 9-septate conidia, averaging 125 to 150 μ (including beak) in length but sometimes attaining 200 μ, the agent of an extensive and injurious spotting of *Zinnia elegans* leaves; and a strain of *Gloeosporium fructigenum* [*Glomerella cingulata*] on rotten cherries [ibid., xiv, p. 40].

Thomas (K. M.). **Administration Report of the Government Mycologist, Madras, for the year 1936–37 (detailed report).**—17 pp., 1 graph, 1937.

Experimental evidence obtained at Coimbatore during the period under review showed that rice plots given nitrogen alone or in

combination with other manurial ingredients had a significantly higher incidence of foot rot (*Fusarium moniliforme*) [*Gibberella moniliformis*: *R.A.M.*, xv, p. 777] than the control plot given a basal dressing of farmyard manure and the plots which did not receive nitrogen. The available evidence indicated that increased incidence is due to the fact that a nitrogen-yielding medium favours the growth of the fungus.

Heavy infections of *Piricularia oryzae* [see below, p. 61] occurred on G.E.B. 24 rice in hilly districts, though this variety is highly resistant in the plains [cf. ibid., xv, p. 779]. Three strains of G.E.B. 24 × Korangu samba crosses have been developed at Coimbatore which are highly resistant to *P. oryzae* and yield 10 to 18 per cent. more than the original Korangu samba stock.

Koleroga disease (*Phytophthora arecae*) [ibid., xv, p. 77] of areca palm [*Areca catechu*] appeared after several years of comparative quiescence in South Kanara in a very virulent form, and growers who failed to spray sustained heavy losses, in some instances amounting to the complete loss of the crop. Studies on the life-cycle of *P. arecae* showed that the fungus is unable to grow and multiply in the soil, though the resting conidia shed in the soil germinate abundantly when optimum moisture is supplied; resting conidia were trapped by aeroscopes at a height of 32 ft. above the ground.

From a disease of areca palm observed locally for the first time and characterized by a die-back of the flowering bunches and a shedding of the female flowers between December and February a *Gloeosporium* was isolated and proved by inoculation experiments to be parasitic on tender areca and coco-nut inflorescences.

Macrophomina phaseoli [ibid., xv, p. 778] was isolated from coriander [*Coriandrum sativum*]. Pot inoculation experiments with the horsegram [*Dolichos biflorus*] strain [loc. cit.] showed that the fungus killed 35, 10, and 0 per cent. of the *D. biflorus* plants in the first, second, and third fortnights, respectively.

Inoculation experiments demonstrated that at least three specialized strains of the fungus causing *Sclerospora* disease of cereals exist, the sorghum strain, infecting only sorghum and maize, the *Pennisetum typhoides* strain infecting only *P. typhoides*, and the 'tenai' [*Setaria italica*] strain infecting only *S. italica*.

In further resistance trials the Co. 213 sugar-cane showed 70 per cent. mosaic, as against 63·5 per cent. in the previous season, while Co. 205 (Pusa), 335, 352, 353, 355, 422, 434, P.O.J. 2878, and Uba remained unaffected [ibid., xv, p. 777]. In individual plants of Co. 361 the symptoms disappeared after a time, and after the canes were cut the ratoon shoots showed no leaf mottle. The growth from setts of such plants did not develop symptoms, and pin-prick inoculations from such plants to a highly susceptible variety such as Co. 213 did not produce infection. The virus in the masked plants presumably becomes attenuated and loses infectivity.

A new disease of red gram [*Vigna unguiculata*] was characterized by leaf mottling, stunting of the plants with leaf dwarfing, and failure to flower. The red gram jassid (*Empoasca* sp.) fed for 24 to 48 hours on infected leaves in two instances transmitted the disease to red gram plants.

Inoculation tests proved that the virus causing yellowing of sorghum [ibid., xv, p. 778] is not sap-transmissible, and that the vector, *Pundalaya simplicia*, is solely responsible for the spread of the disease.

NATTRASS (R. M.). **Annual report of Plant Pathologist for the year 1936.** —*Rep. Dir. Agric. Cyprus, 1936*, pp. 50–56, 1937.

Apart from work already noticed from other sources [*R.A.M.*, xvi, pp. 311, 555] the following items are of interest in this report [cf. ibid., xvi, p. 20]. During 1936, wheat growing in Cyprus was widely affected in certain districts by *Bacterium tritici* [ibid., xiv, p. 742] in association with nematodes, prevalence having increased since the year before. *Helminthosporium sativum* was isolated from the base of young wheat plants [ibid., xvi, p. 735], this being a new record for Cyprus. *Vicia sativa* was severely attacked by chocolate spot [ibid., xvi, p. 723], brown lesions developing on the stems, leaves, and pods, and yielding a *Botrytis* closely resembling *B. fabae*, the spores of which when sprayed on to *V. faba* leaves produced characteristic chocolate spot. *Uromyces ciceris-arietini* [ibid., ix, p. 204] was noted for the first time in Cyprus on *Cicer arietinum*. Tomatoes were again seriously attacked in various districts by *Oidiopsis taurica* [ibid., xvi, p. 588], the disease becoming serious in midsummer and curtailing the productive period of the plants. *Ascochyta* [*Didymella*] *lycopersici* [ibid., xvi, p. 781] was noted for the first time locally on tomato fruits. Other fungi attacking tomatoes included *Alternaria solani* and *Septoria lycopersici*.

Ascochyta pisi not only occurs on peas in Cyprus but also on *V. sativa* [cf. ibid., xiii, p. 612], *Lathyrus gorgonei*, and *L. ochrus*, on the last-named of which it causes serious infection; isolations from these hosts and *V. faba* and one from Baarn sufficiently resembled each other to be considered as one species.

Other records included *Alternaria crassa* on *Datura stramonium* [ibid., xiii, p. 597], *Sclerotinia sclerotiorum* [see above, p. 6] on *Antirrhinum* and, for the first time in Cyprus, on orange fruits [ibid., xv, p. 213], and *Entyloma fuscum* [ibid., xvi, pp. 63, 493], which commonly occurs on *Papaver rhoeas*, on the leaves and inflorescences of *P. somniferum*.

WALLACE (G. B.). **Annual report on plant pathology, 1936.**—*Rep. Dep. Agric. Tanganyika, 1936*, pp. 95–96, 1937.

In this report [cf. *R.A.M.*, xv, p. 703] it is stated that no reason has been found for modifying the view that sisal [*Agave rigida* var. *sisalana*] stump rot [ibid., xiv, p. 678] observed on three plantations in the Tanga district in 1936 is primarily due to soil nutrient deficiency. Maize leaf blight (*Helminthosporium turcicum*) was definitely recorded for the first time from the Iringa district. Evidence was obtained that the sulphur treatment of sorghum seed against grain smut [*Sphacelotheca sorghi*] and loose smut [*S. cruenta*] when carried out for several years in succession [ibid., xii, p. 552] reduces infection to insignificant proportions. Loose smut of wheat (*Ustilago tritici*) was recorded for the first time from Arusha. Loquat root rot was caused by *Armillaria* [*mellea*]. The avocado disease previously reported [ibid., xiv, p. 678] was ascertained to be due to capsid bugs (*Helopeltis*).

Leach (R.). **Report of the Plant Pathologist, Mlanje Experimental Station.**—*Rep. Dep. Agric. Nyasald, 1936*, pp. 25–28, 1937.

This report [cf. *R.A.M.*, xv, p. 779] contains the following items of interest, apart from those already noticed from other sources [ibid., xvi, p. 564].

The planting of 1½-year-old tea stumps (stems cut back to 4 in.) sometimes failed, owing to ringing of the collar, apparently due to scorching, at ground-level, with resultant die-back and death of stump and root, unless suitable weather intervened. An experiment was therefore carried out in which the stumps were grown in shaded and unshaded conditions during all types of weather. The results obtained [which are tabulated] showed after one year significant differences of 3·3, 27, and 20 per cent. in stand in favour of the shaded over the unshaded stumps for (1) ideal planting weather followed by showery, cool weather (typical of a good planting season), (2) ideal planting weather followed by a hot, dry spell (typical of a bad planting season), and (3) planting on 30th December in the middle of a long, hot, dry spell, respectively. This result shows clearly that if shade can be used to prevent the collar of the stumps from being scorched by the hot surface soil a good standard of planting should be attained for all seasonal conditions.

Citrus exanthema [ibid., xvi, p. 741] was observed locally for the first time in January, 1936. Some trees were badly affected and had started to die back. Citrus mottle leaf [ibid., xvi, p. 669] is very prevalent in Nyasaland, but spraying with zinc sulphate and lime has given encouraging results.

Lefebvre (C. L.) & Johnston (C. O.). **Kansas mycological notes, 1935.**—*Trans. Kans. Acad. Sci., 1936*, xxxix, pp. 95–101, 1937.

Among the many items of interest in these notes the following may be mentioned. *Bacterium coronafaciens* [*R.A.M.*, xvi, p. 370] was common on oats in Kansas in 1935, preventing the emergence of the head from the 'boot' in susceptible varieties, e.g., Canadian, Swedish Select, and Green Russian.

The incidence of kernel smut of sorghum (*Sphacelotheca sorghi*) [ibid., xvi, p. 667] was very high, amounting to 25 per cent. of the heads in some large commercial fields and frequently reaching 10 to 15 per cent. An atypical manifestation of the fungus, consisting in the production of large sori on the glumes, panicle branches, rachis, and occasionally on the peduncles below the heads, simulating the attacks of head smut (*Sorosporium reilianum*), was observed in the Manhattan experimental plots.

Bact. coronafaciens atropurpureum Reddy & Godkin was prevalent on *Bromus inermis*, *B. japonicus*, and *B. tectorum*, *Dactylis glomerata* being less severely attacked. The symptoms caused by this organism (a greenish-brown to black discoloration of culms, rachis, and pedicels of the panicle, sometimes entailing a high degree of sterility), are similar to those produced by *Bact. translucens undulosum* on wheat [ibid., xvi, p. 799], suggesting a close relationship between the two.

Late blight of potato (*Phytophthora infestans*) was found in several

fields, this being the first authentic record of its occurrence in the State; the affected plants were raised from seed of Maine origin.

Linospora gleditsiae, the agent of a leaf spot of honey locust (*Gleditsia triacanthos*), was found in both its conidial and perithecial stages [ibid., xv, p. 620].

MÜLLER (A. S.). **Brazil: new plant diseases reported in the State of Minas Geraes during 1936.**—*Int. Bull. Pl. Prot.*, xi, 8, pp. 174–175, 1937.

This is a list of diseases first recorded in the State of Minas Geraes of Brazil in 1936, among which the following may be mentioned: *Exoascus* [*Taphrina*] *deformans* on peach, *Puccinia paulensis* [*R.A.M.*, xi, p. 606] and mosaic on *Capsicum microcarpum*, *Corticium salmonicolor* and psorosis on *Citrus* sp., *Ceratostomella fimbriata* on *Crotalaria juncea*, *Cercospora carotae* on carrots [ibid., xii, p. 356], and *Oidium tuckeri* [*Uncinula necator*] and *Sphaceloma ampelinum* [*Elsinoe ampelina*: ibid., xvi, p. 655] on the vine.

PICKEL (B.). **Lista das molestias e dos fungos parasitarios das plantas cultivadas em Pernambuco.** [List of the diseases and parasitic fungi attacking cultivated plants in Pernambuco.]—*Rodriguésia*, ii, Num. esp., pp. 207–212, 1937.

This is a preliminary, briefly annotated list of the more important parasitic diseases of economic and ornamental crops, which have been studied by the author in Pernambuco, and among which the following may be mentioned: *Cercospora ricini* Speg. on castor bean [*Ricinus communis*] leaves; *Uromyces manihotis* Henn. killing the apical bud of cassava; *Puccinia psidii* [cf. *R.A.M.*, xvi, p. 300] common on the leaves and fruits of guava; and *Asperisporium caricae* [ibid., xv, p. 46] causing a leaf spot of papaws.

MATSUMOTO (T.) & OKABE (N.). **Bacteriophage in relation to Bacterium solanacearum. II. Further studies on the phage and antiphagic serum.**—*J. Soc. trop. Agric. Taiwan*, ix, 2, pp. 205–213, 1937.

A detailed account is given of the writers' studies on the longevity of the bacteriophage of *Bacterium solanacearum* [*R.A.M.*, xiv, p. 686] as influenced by (*a*) varying temperature conditions, and (*b*) the presence of homologous bacteria during the period of preservation. A 24-hour culture of the phage was distributed in small glass tubes which were sealed and maintained at different temperatures for given periods, after which a modicum of the solution was withdrawn from each tube and its lytic activity tested.

The longevity of the *Bact. solanacearum* phage was found to increase parallel with the decline in temperature at which the culture is preserved. The lytic principle lost its virulence, for instance, after 25 to 70 days at 37° C., whereas at 0° its activity was maintained for 700 days. The longevity of the phage varied according to the quality of the potatoes serving for the preparation of the media, being greatly reduced by the use of decoctions yielding a white precipitate on preservation at 0° to 10°. Marked differences were observed in the virulence of the bacteriophage towards three distinct types of *Bact. solanacearum*, viz., 'F' (a fluid form with irregular, milky colonies), 'Op'

(with circular, opalescent colonies), and 'C' (with circular, light brownish, concentric, striate colonies), the first-named being the most susceptible to the lytic action. The neutralization of the phage by antiphagic serum was found to vary with differences in the phagic titre. In one case complete neutralization took place at a dilution of 1 : 10 after two hours at 37°, while in another the same effect was produced at dilutions up to 1 : 80 under the same conditions. The neutralizing activity of the antiphagic serum was not affected by one hour's heating to 50° and little impaired by exposure to a temperature of 60° to 70°, but 20 minutes' heating to 75° induced considerable attenuation. At or above 85° even five minutes' exposure caused a marked reduction of activity, while 20 minutes at 85° or 10 at 90° resulted in almost complete destruction of the neutralizing properties of the serum.

LEVINE (M.). **Tumors of Tobacco hybrids.**—*Amer. J. Bot.*, xxiv, 5, pp. 250–256, 17 figs., 1937.

The author describes spontaneous tumours on *Nicotiana glauca* × *langsdorffii* hybrids [*R.A.M.*, xv, p. 205] which closely resemble crown gall (*Bacterium tumefaciens*) but are distinct from it, and may be compared with teratomata.

LINK (G. K. K.) & WILCOX (H[AZEL] W.). **Tumor production by hormones from Phytomonas tumefaciens.**—*Science*, N.S., lxxxvi, 2223, pp. 126–127, 1937.

The writers give further details of their experiments on tumour production in red kidney beans (*Phaseolus vulgaris*) by hormone extracts (heteroauxones) from *Phytomonas* [*Bacterium*] *tumefaciens*, an account of which [including similar tests on tomatoes] has been noticed from another source [*R.A.M.*, xvi, p. 730].

CONNER (H. A.), RIKER (A. J.), & PETERSON (W. H.). **The carbon metabolism of the crown-gall and hairy-root organisms.**—*J. Bact.*, xxxiv, 2, pp. 221–236, 2 diags., 5 graphs, 1937.

Quantitative data are presented concerning glucose fermentation, fermentation rates, carbon dioxide production, and carbon distribution of the metabolic products of the crown gall and hairy root organisms (*Phytomonas* [*Bacterium*] *tumefaciens* and *P.* [*Bact.*] *rhizogenes*) [*R.A.M.*, xvi, p. 591].

The amount of glucose fermented in a synthetic liquid medium by the two organisms may be increased by raising the concentration of yeast infusion or the addition of 1 per cent. phosphates. Agar media were more satisfactory for fermentation than liquid substrata. *Bact. rhizogenes* was capable of fermenting higher concentrations of glucose more rapidly than *Bact. tumefaciens* and also produced about ten times as much carbon dioxide. Acetic and pyruvic acids were identified as metabolic products of *Bact. rhizogenes*. From 70 to 80 per cent. of the sugar fermented is utilized for the formation of other products, some of which have been isolated and partly characterized. These metabolites differ from bacterial gum in their failure to yield reducing sugars on hydrolysis. The bacterial gum consisted chiefly (72 to 98 per cent.) of glucose units and small amounts (5 per cent.) of uronic acid.

Smith (C. O.). **Crown gall on Incense Cedar, Libocedrus decurrens.**—*Phytopathology*, xxvii, 8, pp. 844–849, 3 figs., 1937.

This is an expanded account of the writer's successful inoculation experiments with cultures of *Pseudomonas* [*Bacterium*] *tumefaciens*, originally isolated from incense cedars (*Libocedrus decurrens*) in California in 1916, on a number of other trees and plants, a note on which has already appeared [*R.A.M.*, xv, p. 138]. Additional hosts of the organism reported in the present study are *Schinus molle* and persimmon (*Diospyros kaki*). Details are given of some atypical manifestations of crown gall on *L. decurrens* resulting from inoculation with cultures from the same host, peach, and willow (*Salix* sp.), including globose structures composed of healed-over tissue, 5 to 15 mm. in diameter, sometimes cracking and producing from their interior rudimentary galls that ultimately assume the typical form, and point-like or papillate projections arising near the site of inoculation or sometimes from the enlarged tissue.

Bondar (G.). **A phytopathologia e a cultura Cacaoeira no Brasil.** [Phytopathology and the cultivation of Cacao in Brazil.]—*Rodriguésia*, ii, Num. esp., pp. 196–197, 1937.

The author states that while *Phytophthora faberi* [*P. palmivora*: *R.A.M.*, xvi, pp. 202, 312] is economically the most important fungal parasite of cacao in Brazil, very little attention so far has been paid to the disease in that country, and advocates a thorough investigation of the problems involved in its development and control.

Garrett (S. D.). **The soil-borne fungus diseases of field and plantation crops: a review of existing control methods.**—*Emp. J. exp. Agric.*, v, 19, pp. 189–196, 1937.

In this survey of the methods of control of fungal root diseases in field and plantation crops the author points out that the problem is common to both temperate and tropical countries, and that most of the more serious fungal root parasites increase only on and in their host. He classifies the available control methods as those aimed at (1) getting rid of the fungus during its passive phase in the soil in the absence of host plants, (2) checking the subterranean activity of the fungus during its active, parasitic phase on the underground parts of the host, and (3) preventing the dispersal of the fungus to fresh areas by such agencies as wind, water, insects, animals, and agricultural practices. Regarding the methods included in the first category the author urges that more attention should be paid to biological control to increase the antagonistic action of soil saprophytes on root parasites, and so enable the period of fallow or alternate cropping necessary for the eradication of infection to be reduced. The second category includes measures designed to increase the resistance of the underground organs (e.g., by the correction of adverse soil factors), roguing, and measures directed at making the soil environment less favourable to the parasitic activity of the fungus. Methods of the third category are not discussed in detail.

Blair (I. D.). **Survey of certain crop diseases in Canterbury and North Otago.**—*N.Z. J. Agric.*, lv, 2, pp. 104–111, 1937.

This is a summarized report on the diseases of cereal crops which

were observed during a survey from December, 1935, to March, 1936, in South Island in the area comprised between Amuri in the north and Waitaki in the south. About 35 per cent. of the oat-growers visited did not disinfect their seed-grain before sowing, a fact which is held to have been responsible for the fairly even distribution of loose and covered smuts (*Ustilago avenae* and *U. kolleri*) in all the districts surveyed; of the two smut species the first, however, was much more common than the second. While Hunters wheat was apparently completely immune from loose smut of wheat (*U. tritici*), 95 per cent. of the Cross 7 crops were infected in some degree with the smut, the susceptibility of Dreadnought, Garnet, Tuscan, Velvet, Marquis, and Jumbuck wheats being in the descending order as listed. Support was found for the American experience that warm and damp weather during blossoming time favours the spread of loose smut of wheat. Wheat bunt [*Tilletia caries* and *T. foetens*] appeared to have been reduced to very little economic significance by the generalized practice of seed disinfection, for which ceresan and agrosan are becoming very popular. The highest percentage infection (60·8) with mildew (*Erysiphe graminis tritici*) was found in Hunters wheat and the lowest (29) in Jumbuck, Tuscan, Velvet and Pearl, Cross 7, and Dreadnought, showing 57·8, 57·0, 39·3, and 30·6 per cent., respectively. In certain districts, where the large number of whiteheads in wheat caused concern among the growers, there were indications that, apart from *Ophiobolus graminis* and other agencies, the condition was due to attacks of foot-rotting fungi (*Fusarium* spp.) [*R.A.M.*, xvi, p. 734].

Pichler (F.). **Saatgutbeizmittel.** [Seed-grain disinfectants.]—*Neuheiten PflSch.*, xxx, 4, p. 151, 1937.

Details are given of certain amendments and amplifications in the list of seed-grain disinfectants officially recognized by the Austrian Plant Protection Service [*R.A.M.*, xvi, p. 88]. Improved fusariol 157 (Chem. Fabrik Marktredwitz) [ibid., xv, p. 83] controls wheat bunt [*Tilletia caries* and *T. foetens*], covered smut of barley [*Ustilago hordei*], and barley stripe [*Helminthosporium gramineum*]. Wheat bunt may also be combated by means of germisan, by salvocer-nassbeize (Kreidl, Heller & Co., Vienna), and by salvocer-einheitsbeize (same manufacturers). Germisan is also effective against *U. hordei* on barley and *Fusarium* [*Calonectria graminicola*] on rye. *U. hordei* yields to salvocer-einheitsbeize and to abavit-neu dust, the latter preparation being applicable to *H. gramineum* on barley and loose smut of oats [*U. avenae*]. The manufacture of cersolit liquid and dust having been discontinued, these preparations are withdrawn from the official list.

Fischbach (H.). **Bayern und die Getreidebeizung.** [Bavaria and cereal disinfection.]—*Nachr. SchädlBekämpf., Leverkusen*, xii, 3, pp. 160–169, 4 figs., 1937. [English, French, and Spanish summaries on pp. 196–197, 200–201, 205.]

The author briefly reviews the development of co-operative seed disinfection in Bavaria [*R.A.M.*, xvi, p. 519] and states that in 1935 71, 88, and 69 per cent., respectively, of the winter rye, wheat, and barley were treated, the corresponding summer figures being 54, 75,

and 57, respectively, and oats 40 per cent. Continuous dusting machinery is now in operation at most of the depots.

LEHMANN (E.), KUMMER (H.), & DANNENMANN (H.). **Der Schwarzrost, seine Geschichte, seine Biologie und seine Bekämpfung in Verbindung mit der Berberitzenfrage.** [Black rust, its history, its biology, and its control in relation to the Barberry problem.]—xxiv + 584 pp., 1 col. pl., 41 figs., 21 graphs, 6 diags., 19 maps, Munich–Berlin, J. F. Lehmanns Verlag, 1937. Price RM. 28 (abroad RM. 21).

This well-presented and richly documented work on black rust of cereals (*Puccinia graminis*), probably the world's most important plant pathogen, is without doubt the largest and most complete monograph yet published on a single plant disease. The book is divided into eight main sections under the headings: introductory; the black rust fungus and its history; the barberry; the history of the struggle against the barberry; the biology of black rust parasitism, (*a*) on cereals, and (*b*) on the barberry; epidemiology of the black rust; the distribution and injuriousness of the rust throughout the world; and control of the rust, with particular reference to the eradication of the alternate hosts, i.e., the barberry and *Mahonia* spp. In a final chapter the authors discuss the measures that should be introduced in Germany [*R.A.M.*, xiv, p. 568] for the suppression of the disease, the control of which can only be obtained by close international co-operation. The information is presented in great detail and the volume constitutes a valuable book of reference for data on this important disease. The bibliography appended covers 57 pages.

MITRA (M.). **Studies on the stinking smut or bunt of Wheat in India.**—*Indian J. agriç. Sci.*, vii, 3, pp. 459–476, 2 graphs, 1937.

The results of investigations from 1934 to 1936, inclusive, at Karna showed that wheat ears infected with bunt (*Tilletia indica*) [*R.A.M.*, xvi, p. 231] are significantly shorter and produce significantly fewer spikelets than normal. On an average for the three years' tests, naturally infected Pusa 114 wheat seed gave 1·48 per cent. bunted plants; seed disinfection with ceresan reduced the percentage infection to 0·14, and with copper carbonate, uspulun, granosan, charcoal formaldehyde, and hot water to 0·25, 0·28, 0·30, 0·42, and 0·54, respectively. Experiments in 1935–6 showed that bunt infection can occur, to a certain extent, when healthy seed is sown in infected soil, and that certain seed disinfectants, such as agrosan G, hortisan A (both at a rate of 2 oz. per bush.), and sulphur (7 oz.), reduce infection from this source. Further experiments showed that bunt does not develop at Pusa even if wheat is sown there in infected soil imported from Karnal. In view of the possibility of infection from the soil, crop rotation is strongly recommended.

PETIT (A.). **Le traitement des semences de Blé tendre contre Ustilago tritici. Trempages de courte durée dans l'eau chaude.** [The treatment of soft Wheat seed-grain against *Ustilago tritici*. Hot water steeps of short duration.]—*C. R. Acad. Agric. Fr.*, xxiii, 21, pp. 672–678, 1937.

In this later account of his experiments in Tunis in 1936 [*R.A.M.*,

xvi, p. 802] on the control of loose smut of wheat (*Ustilago tritici*) by double bath hot-water treatment, the author states that the disease may be reduced to one-tenth of its incidence in the controls by preliminary immersion for 40 minutes at 40° to 48° C.; to one-twentieth by 50 minutes at 38° to 43° or 48°; and to nil by 1¾ to 2½ hours at 35° to 40°; these treatments being followed, in all cases, by a second immersion for 10 minutes at 52°. Total disinfection, however, inhibits germination at low temperatures and necessitates the sowing of 50 per cent. more seed, and is therefore not to be considered as a routine method for obtaining good, regular crops, but only when complete eradication of the disease, in three succeeding crops, is required.

The treated grain should be sown early, and not too deeply, in light, well-prepared soil at a density of one-third as much again as the customary rate, when a yield of two-thirds to four-fifths of that of untreated controls may be anticipated. This economically satisfactory method has been successfully employed on an extensive scale in Tunis for the procurement of large quantities of grain, and the healthy condition of the seed may be expected to persist for at least two generations.

While a single immersion of 1½ to 2 hours at 46° to 48° is completely effective, this method has inherent disadvantages [loc. cit.].

CALDWELL (R. M.). **Rhynchosporium scald of Barley, Rye, and other grasses.**—*J. agric. Res.*, lv, 3, pp. 175–198, 4 pl., 3 figs., 1 graph, 1937.

In giving a full report of his investigations, started in 1926 in Wisconsin, of the *Rhynchosporium* scald of barley, rye, and other grasses [*R.A.M.*, viii, p. 371; xiv, p. 429], the author states that in the Pacific Coast States the trouble is one of the principal limiting factors in barley production, the losses directly attributable to it having been estimated at from 20 to 30 per cent. A critical study of the taxonomy and nomenclature of the genus *Rhynchosporium* led him to present an emended description of the genus, based on the distinctive fertile stroma and the production of sessile conidia directly on it as seen in the type species. *R. secalis* (Oud.) Davis occurring on barley, rye, and a number of grasses. The fungus causing scald of *Dactylis glomerata* differs from this species in having cylindrical instead of apically beaked conidia, and is described as a new species under the name *R. orthosporum* [with a Latin diagnosis]. *R. alismatis* (Oud.) Davis, occurring on *Sagittaria* and *Alisma* spp., is excluded from the genus.

R. secalis was found to exhibit a high degree of host specialization; cross-inoculations showed the existence of six specialized races, characterized by their behaviour on rye, barley, *Agropyron repens*, *Bromus inermis*, *Elymus canadensis*, and *Hordeum jubatum* in the greenhouse and in the field. The conidia of the different races produced on the hosts did not show any important morphological differences, but distinct and constant differences both in the shape of the conidia and in cultural characters were observed between the races in pure culture. The conidia germinated readily in distilled water at temperatures from 4° to 28° C., the optimum temperature for elongation of the germ-tube being between 18° and 21°. Fructification of the fungus occurs abundantly at high humidities and is inhibited by low relative humidities.

Infection on barley is effected by direct penetration of leaf cuticle from appressoria, the mycelium establishing itself and making its initial development under the cuticle, whence it penetrates the underlying epidermal cells and then sparsely into the mesophyll, causing the collapse of these tissues. The cuticle is pushed away from the epidermal wall by the developing subcuticular mycelium, which then forms a fertile stroma, one to several cells in thickness, over the surface of the lesion. In Wisconsin the barley strain of *R. secalis* has been shown to overwinter on the dead tissues of plants from the preceding crop.

Ikata (S.), Kasai (I.), Yosida (M.), & Yokota (I.). **Vitality of spores of stripe-disease fungus on Barley which have passed through the alimentary canal of cattle.**—*Agric. & Hort.* [*Japan*], xi, pp. 2164–2174, 1936. [Japanese. Abs. in *Jap. J. Bot.*, ix, 1, p. (6), 1937.]

Conidia of *Cephalosporium gramineum* Nisikado & Ikata, the agent of a stripe disease of barley in Japan [*R.A.M.*, xiii, p. 623], were found to pass quite unchanged, as regards morphology, viability, and pathogenicity, through the alimentary canal of cattle and poultry fed on infected culms and grains. One of the reasons for the striking retention of vitality by these organs is their adaptability to a wide range of hydrogen-ion concentrations, enabling them to withstand the acidity of the alimentary canal.

Brown (Mabel R.). **A study of crown rust, Puccinia coronata Corda, in Great Britain. I. Physiologic specialization in the uredospore stage.** —*Ann. appl. Biol.*, xxiv, 3, pp. 504–527, 1937.

Details are given of greenhouse experiments, conducted from 1932 to 1934 in England and during the following year in Canada, the results of which allowed the author to differentiate seven pathologically distinct varieties of *Puccinia coronata* [*P. lolii*: *R.A.M.*, xii, p. 364; xv, p. 9; xvi, pp. 245, 446, and next abstract] in Great Britain, namely, var. *alopecuri* parasitic on *Alopecurus pratensis*, var. *arrhenatheri* on *Arrhenatherum avenaceum*, var. *avenae* on *Avena* spp., var. *calamagrostidis* on *Calamagrostis lanceolata* and *Phalaris arundinacea*, var. *festucae* on *Festuca elatior*, var. *lolii* on *Lolium perenne*, and var. *holci* on *Holcus lanatus*, the two last-named of which have also been distinguished in North America. It was further shown that, while the varieties *holci* and *arrhenatheri* are strictly specialized to their own hosts, the other five varieties can all infect to some extent *Dactylis glomerata*, *P. arundinacea*, and *C. lanceolata*, and that the variety *lolii* can infect seven of the twelve differential hosts tested. Inoculation experiments carried out under different conditions of temperature and illumination indicated that the type of infection produced was but slightly influenced by variations in these factors. Marked variations were observed in the reaction of the different species of grasses when inoculated with one and the same culture of rust under identical conditions, this being probably due to genetic impurity of the grasses tested. Four physiologic races were recognized in the variety *avenae* from uredospores collected on oats, namely races 6 (previously identified in North America and Australia), 42 and 44 (both new) from England, and race 43 (also new) from Portugal. Race 42 is somewhat similar to race 9 but differs

in heavily infecting Glabrota, Belar, and Green Russian; race 43 resembles race 1 but differs in giving type 1 infection on Belar; and race 44 closely resembles 38 but causes heavy infection on White Tartar. It is also believed possible that other varieties of *P. coronata* may eventually be similarly subdivided into physiologic races, if pure lines of the host plants become available. From a practical standpoint the investigation indicated that grasses infected with *P. coronata* are seldom likely to be a cause of danger to cultivated oats.

No clear-cut evidence, either morphological or pathological, was obtained supporting Klebahn's division of Corda's species into *P. coronata* Kleb. and *P. coronifera* Kleb. (*P. lolii* Niels.), since most varieties were capable of infecting both *coronata* and *coronifera* hosts.

MURPHY (H. C.), STANTON (T. R.), & STEVENS (H.). **Breeding winter Oats resistant to crown rust, smut, and cold.** *J. Amer. Soc. Agron.*, xxix, 8, pp. 622–637, 1937.

The results of greenhouse, laboratory, and field reaction trials in Iowa, Idaho, and Virginia on selections from Lee × Victoria and Hairy Culberson × Victoria oat crosses, using as foundation stocks 47 F_2 plants out of about 600 showing a tendency towards a winter habit in the seedling stage, are tabulated and discussed in relation to cold, physiologic race 1 of crown rust (*Puccinia coronata*) [*P. lolii*: see preceding abstract], and loose smut (*Ustilago avenae*) (similar to, or identical with, Reed's Missouri strain) in the F_3, F_4, F_5, and F_6 generations.

The distribution of F_3 plants on the basis of their reaction to *P. coronata* in the greenhouse suggests a genetic ratio of 1 : 2 : 1 in the F_2 for resistance, heterozygosity, and susceptibility. Most F_4 families of both crosses showed a satisfactory degree of resistance to crown rust. In most cases the character of resistance to crown rust in the seedling stage is analogous to that manifested in adult plants. Smut occurred in only two F_4 families of the Lee × Victoria cross and in none of the Hairy Culberson × Victoria combination. Of the 123 selections of both crosses tested in the F_5, 77 were resistant to smut in Idaho and Virginia. Under field conditions in Idaho in 1936 smut developed in 6 of 33 F_6 progenies.

BARGER (G.). **The alkaloids of ergot.**—*Analyst*, lxii, 734, pp. 340–354, 1 pl., 4 figs., 1937.

This is a critical review of outstanding investigations on the rye ergot (*Claviceps purpurea*) alkaloids [*R.A.M.*, xvi, p. 448], accompanied by full details of their constitution, directions for chemical and physical methods of assay, and observations on the toxicology of the substances.

PASINETTI (L.). **La 'bacteriosi del Mais' in Italia da 'Aplanobacter stewarti' Smith. Nota II.** [The Maize bacteriosis in Italy caused by *Aplanobacter stewarti* Smith. Note II.]—*Riv. Pat. veg.*, xxvii, 7–8, pp. 221–229, 1937.

In 1936 maize growing in the vicinity of Milan was again attacked, with increasing severity, by *Aplanobacter stewarti* [*R.A.M.*, xv, p. 573] (or at any rate by an organism very probably identical with this

species), the losses ranging from not less than 40 up to 90 per cent. of the crop. Apparently, the disease has been present but unnoticed for some years, having been brought in on seed from America.

Inoculation tests were carried out with four strains of the organism isolated from diseased plants on Pignoletto maize seedlings wounded in the collar and on the leaves, and grown in the laboratory in pots kept moist and at temperatures ranging from 10° C. at night to 20° by day. In all cases typical symptoms developed immediately after the unfolding of the third or fourth leaf. When a few plants of Rosso Siculo sorghum were similarly inoculated they remained apparently healthy, but the organism was reisolated from them in an active condition.

MATSUMOTO (T.) & OKABE (N.). **Preliminary note on the bacteriophage for Bacterium citri (Hasse) Doidge.**—*Agric. Hortic.* [*Japan*], xii, 8, pp. 2055–2059, 1 fig., 1937. [Japanese, with English summary.]

From the soil in which citrus plants infected with *Bacterium* [*Pseudomonas*] *citri* were growing, and on one occasion from infected leaves, the authors isolated the bacteriophage for the organism [cf. *R.A.M.*, xv, p. 395]. It was highly specific, being unable to attack any one of 19 different species of bacterium other than *P. citri*. The multiplication of the lytic principle was more abundant in potato dextrose solution than beef extract, and appeared to be greatest at 30° C.

RUEHLE (G. D.). **A strain of Alternaria citri Ellis and Pierce causing a leaf spot of rough Lemon in Florida.**—*Phytopathology*, xxvii, 8, pp. 863–865, 1 fig., 1937.

During 1936 and 1937 a leaf spot of rough lemons (*Citrus limonia*), similar to that described by Ethel M. Doidge from South Africa as due to *Alternaria citri* [*R.A.M.*, xvi, p. 601], was observed to be causing extensive defoliation in Dade County, Florida, where the lesions were occupied by a species of *Alternaria* frequently associated with *Colletotrichum gloeosporioides* [ibid., xvi, pp. 599, 601, *et passim*], the latter predominating in mixed infections. The irregular, light to dark brown lesions, the margins of which are typically darker than the centres, do not usually exceed 2 cm. in diameter unless secondary *Colletotrichum* infection is present. In cases of multiple infections the whole leaf blade becomes chlorotic, tending to curl upwards and drop prematurely, but where there are only one or two spots the dead areas may weather away, leaving jagged holes. The spores of the *Alternaria* formed in profusion on the leaves are obclavate and elongated, fuscous, 40 to 70 by 12 to 20 μ, tapering upwards into a narrow, subhyaline beak, 7 to 35 μ in length, and are provided with 3 to 9 (usually 6 or 7) transverse septa. A comparison of the leaf-spotting *Alternaria* with *A. citri* from fruit rot revealed the essential similarity of the two forms. In cross-inoculation experiments on rough lemons and Rangpur limes the fruit rot strain failed to infect the leaves, while the leaf-spotting form of *A. citri*, though able to cause fruit rot of oranges and lemons, did not sporulate in the diseased tissues. Bordeaux mixture has given satisfactory control.

TAKIMOTO (S.). **Defoliation or rot disease of the Satsuma Orange.**—*Studia citrol.*, vii, 2, pp. 176–184, 5 figs., 1936. [Japanese, with English summary. Received November, 1937.]

Inoculation experiments are stated to have proved that *Gloeosporium foliicolum* [*R.A.M.*, iii, p. 133; xii, p. 396] in Japan is a weak parasite causing secondary infection of sunburnt Wase Satsuma orange [*Citrus nobilis* var. *unshiu*] fruits and the leaves of trees of the same variety debilitated by winter injury, defective soil, malnutrition, spray injury, and certain unknown causes. *Gloeosporium* spp. isolated from this host are not always morphologically similar, but they always resemble each other in pathogenicity.

Mould in Citrus fruits. Suggestions for control.—*J. Dep. Agric. Vict.*, xxxv, 6, pp. 261–269, 7 figs., 1937.

A survey made in 1935 of the citrus packing-houses in New South Wales, Victoria, and South Australia disclosed that the methods of handling the fruit and maintaining shed hygiene are responsible for wastage losses, chiefly caused by green and blue moulds (*Penicillium digitatum* and *P. italicum*) [*R.A.M.*, x, p. 517; xvi, p. 233]. The conditions requisite for infection are (1) rind injury, (2) the presence of the mould spores in the atmosphere, and (3) storage environment suitable for rot development. These factors should be eliminated as far as possible.

The procedure that should be adopted to avoid rind injury during picking and in the packing-shed is described in detail. The practice of laying the picking-boxes on the ground before picking is liable to introduce soil into them, and it is recommended that they should be placed on two lengths of timber. The hopper into which the fruit is tipped in the packing-house should be maintained in good repair, so that the nails holding the covering material in place are not exposed, and it is suggested that the floor of the hopper should consist of parallel steel bars covered with rubber. Dry brushes are liable to injure the fruits, and should be sprayed five minutes before scrubbing is begun. Drying in an air-tunnel is more hygienic than towelling. Wounding in the moving conveyor may be eliminated by the regular sandpapering of roughened surfaces, or by the provision of a rubber flap along the sides of the conveyor.

The reduction of sources of contamination may be effected by the periodic collection and destruction of mouldy fruits in the orchard, spraying the picking-gloves and aprons with chlorine solution (10 parts available chlorine per million) at the end of the day, steam sterilization of the picking-boxes, sweating the fruit in the grove, not in the packing-shed, the avoidance of introducing even a single mouldy fruit into the packing-plant, the strict disposal of waste fruits, and washing the floors and plant nightly with 0·5 per cent. caustic soda.

The development of mould in storage largely depends on temperature, ample moisture for spore germination being supplied by the orange itself. R. G. Tomkins has shown that at 75° F. an infection spot will reach 1 in. in diameter in 3 days, whereas at 40° it requires 30 days to do this. These figures explain in part why waste is more prevalent in

late than early Washington Navel oranges. This temperature factor, however, cannot be controlled without the provision of cool storage.

[This report, issued by the Citrus Preservation Technical Committee, composed of representatives of the Departments of Agriculture of New South Wales, Victoria, and South Australia, and the Council for Scientific and Industrial Research, also appears in *Fruit World, Melbourne*, xxxviii, 4, pp. 20–22; 5, pp. 12–13, 1937.]

Reichert (I.) & Littauer (F.). **A new method of control of wastage in Oranges.**—Reprinted from *Hadar*, x, 7–8, 13 pp., 2 figs., 1937.

A new method is described for controlling wastage from *Diplodia* stem-end rot [*D. natalensis*] and *Penicillium* mould [*P. digitatum* and *P. italicum* : *R.A.M.*, xvi, pp. 668, 744] on Palestinian oranges destined for export. It consists in dropping on to the stem end from a pipette one drop of a disinfectant. The best results were obtained with a solution known as 'iodine no. I', consisting of 13 gm. iodine, 10 gm. potassium iodide, 200 c.c. water, and 800 c.c. alcohol, which in a test in 1936 reduced *D. natalensis* in inoculated fruits stored for four weeks from 52 to 14·5 per cent.; in a further test in 1937 with uninoculated fruits it reduced *D. natalensis* from 2·3 to 0·7 per cent., and the *Penicillium* moulds from 8·7 to 0·4 per cent. The next best control was given by borax, which reduced the moulds from 8·7 to 0 per cent., and (in 1936) reduced *D. natalensis* from 52 to 29·5 per cent., after four weeks. In 1937, however, it failed to control *D. natalensis*.

Fawcett (H. S.). **Observations on Citrus conditions in Brazil.**—*Calif. Citrogr.*, xxii, 10, pp. 456, 459, 3 figs., 1937.

Most of the information given in this interesting account of the author's observations on the citrus industry of Brazil made during a five months' stay in the country has already been noticed from another source [*R.A.M.*, xvi, p. 603]. Leprosis is stated to be important in some localities of the State of São Paulo.

Bitancourt (A. A.) & Jenkins (Anna E.). **Variações de Elsinoe australis Bitancourt e Jenkins.** [Variations of *Elsinoe australis* Bitancourt & Jenkins.]—*Rodriguésia*, ii, Num. esp., pp. 315–317, 1 diag., 1937.

As illustrating the great variability in pure culture of *Elsinoe australis* [*R.A.M.*, xvi, p. 451], the authors state that a culture of the fungus isolated from Bahia orange (*Citrus sinensis*), while being subcultured on potato dextrose agar, produced a sector characterized by its velvety type of growth, which on further subculturing produced black, ash-coloured, red, and white sectors of the same type. When inoculated into and reisolated from a 'cravo' orange (*C. nobilis* var.) fruit, the same culture produced on potato dextrose agar velvety black, and red and white viscous sectors. The fact that when first reisolated from the 'cravo' orange the fungus did not differ in its type of growth from the original culture is considered to indicate that variation in the fungus is not induced by passage through different hosts.

Reed (H. S.) & Parker (E. R.). **Effects of zinc on growth.**—*Calif. Citrogr.*, xxii, 9, pp. 411–412, 1 graph, 1937.

To ascertain the effect produced on orange shoots by the application of the zinc spray used against mottle leaf [*R.A.M.*, xvi, p. 669] 30-year-old Valencia orange trees severely affected for many years were sprayed in March, 1934, with a mixture containing 10 lb. commercial zinc sulphate and 5 lb. hydrated lime per 100 galls. water. A few weeks later improvement was noted in the amount and character of the spring growth, and this improvement was maintained during the two following seasons, though the unsprayed controls were unthrifty and showed typical mottle. Other affected trees sprayed in October, 1934, showed normal growth the following spring.

The old, dwarfed leaves on the treated trees did not become normal in size or shape after spraying, but they produced chloroplasts and assumed a normal green colour. In May, 1935, many treated twigs showed the small, elliptical-lanceolate leaves characteristic of unsprayed, affected trees and normal green leaves of the 1934 growth cycle. The striking transition from dwarfed to normal leaves coincided with the production of the first cycle of growth after spraying, indicating that the zinc was quickly absorbed by the tree and rapidly affected the metabolism of the affected organs. The profound improvement in growth is also shown by the longer shoot growth, greater distance between the leaves, and the presence of blossoms. The xylem cylinder of twigs from sprayed trees averaged 518·5 and 716·4 μ for twigs 14 and 26 months old, respectively, as against 381·3 and 630·8 μ for unsprayed twigs of the same ages, respectively.

Ward (F. S.). **Deterioration of copra caused by bacteria and moulds.**—*Sci. Ser. Dep. Agric. S.S. & F.M.S.*, 20, pp. 95–108, 1937.

Fungi commonly present on copra in Malaya [*R.A.M.*, xiii, p. 216] are the *Aspergillus niger* group and its allies, *A. wentii*, *A. ochraceus*, *A. tamarii* and their allies, the *A. flavus-oryzae* group, *A. glaucus*, *Penicillium glaucum*, a Saccharomycete, and *Rhizopus* (? *nigricans*), while *Ceratostomella adiposa* [ibid., xiv, p. 274], *Trichothecium roseum*, and a species of *Colletotrichum* are occasionally present. Two species of rod-shaped bacteria are associated, separately and together, with the slime found on wet coco-nut during drying.

Certain moulds (e.g., *A. flavus*, *A. niger*, and *A. tamarii*) penetrate into the copra and cause more damage than others which grow on the surface. In inoculation experiments [which are described] *A. flavus* (sclerotia-producing) showed better penetration of coco-nut meat not exposed to bacterial action than either *A. niger* or *A. tamarii*, both of which made about equal progress. Inoculations with bacteria alone gave much less deterioration, while similar tests with *A. flavus* (sclerotia-producing) on copra already inoculated with bacteria indicated that continued bacterial action inhibited germination of the mould spores, though when the inoculations were made simultaneously the spores germinated and caused penetration.

In general, the *A. glaucus* group and *P. glaucum* were found to prefer a moisture content of about 7 per cent., while the *A. tamarii*, *A. wentii*,

and *A. ochraceus* groups prefer one of about 12 per cent., and the *A. niger* group, *R.* (? *nigricans*), and *C. adiposa* one between 15 and 20 per cent. The sclerotial form of *A. flavus* appears to be the most important species found on copra owing to its tolerance of a wide moisture range, ranging from 7 to 15 per cent., with an optimum between 12 and 15 per cent.

Prepared copra deteriorated rapidly under the combined action of bacteria and penetrating moulds (chiefly *A. flavus*) when the moisture content of the copra was over 12 per cent. and room humidity and temperature over 80 per cent. and between 28° and 30°, respectively. Below 12 per cent. moisture *A. flavus* grew superficially but penetration of the tissues was limited to isolated areas where the bacteria had been able to establish themselves prior to fungus invasion. Under the same room conditions no bacterial development occurred on copra dried to 6 per cent. moisture content, while slight bacterial development was artificially produced on copra with a moisture content between 6 and 8 per cent. at room temperature under 43° and humidity over 80 per cent.

The bacteria causing copra deterioration appear able to remain dormant indefinitely on copra of 6 to 8 per cent. moisture content, under ordinary local conditions of temperature and humidity. The same applies to some of the penetrating moulds, such as *A. flavus* and *A. niger*, which by producing sclerotia resist adverse conditions indefinitely. These sclerotia did not develop on copra of 6 to 8 per cent. moisture content, even when moistened or kept in a humid atmosphere, though *A. glaucus* grew on copra kept under similar conditions.

The classification of copra moulds on a colour basis is unreliable, one colour sometimes including more than one species.

Bliss (D. E.). **The spread of decline disease in Date Palms.**—*Fourteenth Rep. Date Grs' Inst.*, pp. 4–8, 1937.

Since 1921 the number of date palms affected with decline disease associated with species of *Omphalia* [*R.A.M.*, xv, p. 15] in California has increased from one to approximately 800, the disease now being present in 21 gardens in Coachella Valley and one experimental planting at Riverside. Laboratory studies showed that the different strains of *Omphalia* associated with the disease belonged to two groups or species, technical descriptions of which are being prepared for publication elsewhere. These fungi are able to exist indefinitely as saprophytes on organic matter and are possessed of remarkable longevity under conditions unfavourable to growth. Either one or other of the two species have been found in 14 different gardens and they are regarded as the specific causal organisms of the decline disease. Root specimens from 21 palms surrounding an affected area showed *Omphalia* present in 9 of the palms, 7 of which showed no external symptoms. Thus a diseased area of 13 visibly affected palms actually included 20 affected palms when laboratory diagnosis was applied. This result indicates that the first phase of the disease is confined to the roots, injury to which may be far advanced before the aerial parts show any signs of infection.

The spores of the two species do not appear to play an important part in dissemination. The results of a transplanting experiment are

considered to show that the disease is transmitted on offshoots from diseased palms, while detached portions of affected palms appear to be potential carriers of the disease. Rhizomorphs were noted on the surface of the roots, though as yet there is no actual proof that they spread from one palm to another; apparently the mycelium grows through the soil. Progress of the disease appears to be favoured by those environmental conditions favouring the commercial production of the fruit. Five years are tentatively regarded as the period necessary after inoculation for the development of characteristic symptoms.

The highly susceptible Deglet Noor palm now represents approximately 90 per cent. of the 3,200 acres of commercial plantings in Coachella Valley. Only slight losses have been caused so far, taking the affected area as a whole, the affected palms amounting to about 0·5 per cent. of the total acreage; in certain gardens, however, where the disease has been present for ten years at least, injury has lately increased so rapidly as to have assumed major importance.

It is suggested that further spread may be checked by soil disinfection [loc. cit.], and the use of healthy offshoots only for planting. Control by means of soil disinfection is rather expensive and does not prevent reinfestation, but it is believed to be effective and to be well adapted for stamping out small areas of infection.

Bliss (D.). **Crosscuts in the fruitstalks of Date Palms.**—*Fourteenth Rep. Date Grs' Inst.*, pp. 8–11, 2 figs., 1937.

Date palms growing in California are affected by a condition, designated 'crosscut disease', in which the fruit stalks develop fractures near the point of attachment of the spadix to the trunk. The surrounding tissues are commonly invaded by fungi and bacteria but sometimes remain free from infection. Affected fruit stalks wilt and die, the time required for this process depending on the severity of the fracture. When severance is only partial, wilting and necrosis are gradual, the injury beginning at the distal end of the fruit strands and progressing backwards towards the fracture. Injury is most common between March and June, when fruit stalk elongation is most rapid and the fruits are the size and colour of peas.

In 1934 about 1,000 fruit bunches were lost as a result of crosscut disease in one garden, but losses since then have been small. In another garden the trouble has become progressively worse for seven years, and has repeatedly caused losses of fruit. Generally speaking, however, the disease is of little economic importance. The disease is most prevalent on the Sayer variety, but occurs occasionally on Dayri, Maktoom, Khadrawy, and Halawy.

Inoculations with a culture of a *Fusarium* species isolated from an affected stalk into artificial wounds in the leaf bases of a date palm showed it to be pathogenic, while other cultures of *Fusarium* from leaves and inflorescences were mildly pathogenic in wounded leaf tissue. The evidence is considered to suggest, however, that crosscuts are associated with structural weaknesses in the tissue, there being no indication that the fungi present will initiate such fractures as occur on the diseased trees. One inflorescence showed the presence of saucer-shaped cavities within the stalk.

In commercial plantings of the Sayer variety injury from crosscut is provided for by retaining an excess of fruit bunches, so that an adequate harvest may be secured.

MAYNE (W. W.). **Annual Report of the Coffee Scientific Officer, 1936–1937.**—*Bull. Mysore Coffee Exp. Sta.* 16, 15 pp., 1937.

Coffee sprayed against leaf disease [*Hemileia vastatrix*: *R.A.M.*, xv, p. 798] in Mysore during the hot season, 24, 38, 52, and 66 days after the blossom shower showed, respectively, 48·9, 56·1, 58·1, and 41·1 per cent. infection of the surviving leaves and 61·9, 56·7, 52·6, and 41·1 per cent. leaf survival. The non-cropping shoots showed similar though less well-marked effects from the different sprays, the second giving the best leaf survival. Taken as a whole the data indicate that it is less important to cover the maximum leaf area than to check the first increase in the disease after the blossom showers.

Laboratory studies showed that the endosperm of the coffee seed passes through a long rest period after fertilization, during which there is considerable growth activity in the nucellar tissues surrounding the fertilized embryo sac. These tissues develop and form a scaffolding within which the true endosperm develops. In this connexion it is pointed out that coffee black bean [ibid., xiv, p. 164] is associated with disturbances in the relation between the developing endosperm and the degenerating nucellar tissues, the condition resulting from abnormal activity in the latter.

From a die-back of the tops of young Robusta coffee trees [cf. ibid., xi, p. 636] a *Macrophoma* was isolated which all the evidence indicated as the cause of the disease, though this was not proved by inoculation tests. Infection appeared to have taken place through scars left during suckering. Only a few infections were noted during the wettest period of the south-west monsoon.

MAYNE (W. W.). **Factors affecting spray success in the control of Coffee leaf disease (Hemileia vastatrix B. and Br.).**—*Bull. Mysore Coffee Exp. Sta.* 15, 46 pp., 2 graphs, 1937.

A full account is given of a six years' study conducted at the Coffee Experiment Station, Mysore, of the principal factors, contributed by the host, the parasite, and the environment, governing the incidence of coffee leaf disease (*Hemileia vastatrix*) [see preceding abstract] in southern India, and of the relation of these to the problem of spraying.

The data obtained [which are tabulated and fully discussed] showed that there are locally two main periods of leaf development [*R.A.M.*, x, p. 239; xi, p. 368], one during the hot weather (March to May), when at least 60 per cent. of the total leaf growth is produced, and the other during the late north-east monsoon (mid-September to November). The disease becomes active as the hot-weather showers set in, usually about the middle of March, and the severity of the outbreak by the end of September depends on the start the disease has had and its rate of development during the hot weather. The chief source of inoculum lies in the diseased leaves which are carried through the dry season (December to February) and are present at the time of the blossom showers;

the other main factor affecting the start of the disease is the distribution and frequency of the rains in the hot weather. The amount of disease available at the end of the dry weather in unsprayed areas seems to be strongly affected by the length of the preceding drought, and the length of the drought from the end of the north-east rains until the blossom showers appears to be closely related to the subsequent severity of infection. The south-west monsoon (June to mid-September) exerts little influence on the disease.

Experimental evidence demonstrated that optimum protection of the leaves results (under local conditions) from spraying when they are not more than about one month old. If, however, the initial sources of the disease at blossom time are few, spraying may with advantage be delayed a little. The second (post-monsoon) spray is probably most effective when the outbreaks are mild and occur late. Successful control depends on (*a*) the reduction of the number of centres of infection carried through the dry weather, (*b*) the adjustment of spraying times to the times of leaf expansion and the suitable age of the maximum amount of leaf, and to the disease situation at blossom time or the end of August, and (*c*) the rapid completion of the spraying.

In an estate experiencing climatic conditions similar to those under which the above-mentioned observations were made the general procedure should be as follows. At the end of February the amount of leaf carried in the different fields should be noted, any area with a heavy head of leaf being presumed to carry many centres of infection. At blossom shower time the rainfall records must be carefully inspected to ascertain whether the dry period has been short or long, and this will indicate whether spraying can safely be delayed to increase the proportion of flush covered. If the conditions appear to favour infection, spraying should be begun not later than 25 to 30 days after the blossom shower, starting in the fields with the best-developed foliage. If the blossom shower is small and growth is delayed, spraying should also be delayed, and if the blossom shower is heavy, and growth starts vigorously, but the three weeks or so after the blossom shower are dry, then the spray may also be delayed somewhat. When the blossom shower is early a second spraying may be advisable, particularly if the weather just after the blossom showers is wet. In August, if infection is not severe, and the post-monsoon flush is marked, the second spray should be given as soon as possible, but when the disease is very severe and leaf growth is delayed, the second spray should be deferred until about a month after the new flush has become vigorous. The pre-monsoon spray should be applied earlier to areas carrying a large head of leaf through the dry weather and to sheltered areas, provided the trees are not more liable to black rot [*Corticium koleroga*] than to leaf disease, in which case they should be sprayed later. Areas carrying a small head of leaf through the dry weather, or where the disease usually appears late, should be sprayed later than others.

Azevedo (N.). **Relação bibliographica referente a fungos e doenças do Cafeeiro.** [Bibliographical references relating to the fungi and diseases of Coffee.]—*Rodriguésia*, ii, Num. esp., pp. 213–238, 1937.

In a brief foreword the author states that the great majority of the

papers on coffee diseases cited in this bibliography [comprising 217 titles] have been listed by him from the *Review of Applied Mycology* for the years 1925 to 1935, inclusive. Besides an alphabetical enumeration of the authors, the diseases are also listed in the alphabetical order of the Latin names of the causal organisms.

RUDIN (W.). **Topsterftebestrijding in de practijk, II.** [Top die-back control in practice, II.]—*Bergcultures*, xi, 23, pp. 847–849, 1937.

In connexion with the discussion which has been proceeding as to the most efficient method of combating top die-back of coffee [*Rhizoctonia* sp.] in the Dutch East Indies [*R.A.M.*, xvi, p. 798], the writer emphasizes the need for caution in pruning operations to avoid heavy losses of fruit-bearing wood and berries, especially in old, topped plantations where the coolies cannot easily distinguish between the injuries due to this disease and abnormalities resulting from other causes. It is suggested that the work of excision of infected material should be preceded by preliminary surveys, at intervals of 14 to 20 days, to ascertain the extent of the damage and prune diseased branches lightly, progressing gradually to more radical methods where indicated. In the case of young trees in the early stages of die-back, it is not advisable to cut the affected branches right down to the point of insertion on the stem, since in some cases at any rate infection will be confined to the periphery and readily eliminated by the removal of the tips.

VASUDEVA (R. S.). **Studies on the root-rot disease of Cotton in the Punjab. IV. The effect of certain factors influencing incidence of the disease.**—*Indian J. agric. Sci.*, vii, 4, pp. 575–587, 4 graphs, 1937.

Continuing his studies on cotton root rot (provisionally attributed to *Rhizoctonia bataticola*) [? *Macrophomina phaseoli*] and *R.* [*Corticium*] *solani* in the Punjab [*R.A.M.*, xvi, p. 672], the writer carried out a number of experiments on naturally or artificially infected soil to determine the influence of various factors on the incidence of the disease.

Four years' tests on the relation of watering to root rot in *Gossypium indicum* var. *mollisoni* (No. 15) showed a progressive decline in the percentage of infection with a reduction in the number of irrigations, the figures being particularly suggestive in 1933, when the percentages of root rot mortality with 5 and 2 irrigations were 32·39 and 22·78, respectively, and in 1935 (80·11 per cent. infection with 7 irrigations and 50·27 with 3). A close correlation was further established, on the basis both of field records and controlled greenhouse trials, between the amount of soil moisture and the extent of root rot. Both the fungi implicated caused heavy infection (up to 100 per cent.) at 15 and 20 per cent. soil moisture, whereas at 5 per cent. no pathological symptoms developed in the test plants. Late sowing (after the end of May) was found in experiments at Lyallpur and Khanewal to contribute to the reduction of root rot both in native and American cotton varieties, since the resultant stands escape the period of maximum virulence of the causal organisms. No root rot symptoms have been observed in the indigenous types of cotton in the non-irrigated areas, e.g., of the Ambala district, though the two fungi concerned were isolated from the roots of the plants. For some reason requiring further investigation

local conditions are unfavourable to the development of these organisms in an actively parasitic form. Some evidence was obtained that the application to the plots of farmyard manure at the rate of 1,000 maunds [37,327 kg.] per acre about a month before sowing exerted a beneficial action on the health of the plants, which was apparently not affected, however, by the method of sowing, namely, on ridges or flat.

Panse (V. G.) & Patel (A. F.). **A genetical study of roots in relation to disease-resistance in Cotton.**—*Indian J. agric. Sci.*, vii, 3, pp. 451–457, 1937.

To ascertain whether any genetical relationship exists between root characters and the incidence of root rot of Gujarat cottons (*Macrophomina*) [*phaseoli*: see preceding abstract] a rapid method of examining the roots was devised, in which the selected plants were profusely watered and next morning the roots gently dug out in stages (about 4 or 5 in. at a time), the soil being removed with the help of the hands, until the tap-root could be traced no farther. In this way two men exposed the roots of 35 to 40 plants per day. The characters studied were (1) the total length of the tap-root, (2) the diameter in the topmost and second region of 15 cm. length, and (3) the total number of laterals in regions one and two and the remaining portion. In this way, the root-rot resistance of selected cottons was compared with that of the susceptible variety Broach 9 as control. Two pairs of plants, each consisting of a plant of the strain being tested and a Broach 9 plant from the neighbouring row, were selected at random from each plot, and the character examined was recorded as an average difference per plot between the strain and the control, the latter value being subtracted from the former.

The [tabulated] results showed clearly that a long tap-root, profuse branching below 15 cm., and the presence of few laterals in the first 15 cm. of the soil are associated with root-rot resistance in the varieties studied, and that significant differences exist in these root characters between varieties with different degrees of susceptibility, and also between resistant and unselected plants of the same strain. This last result is regarded as of much practical importance to plant breeders and to justify the selection within a strain of single plants based on desirable root characters.

Rogers (C. H.). **The effect of three- and four-year rotations on Cotton root-rot in the central Texas Blacklands.**—*J. Amer. Soc. Agron.*, xxix, 8, pp. 668–680, 5 diags., 1937.

Three-year rotation combinations of maize, oats, sorghum, or fallow with cotton were ineffectual against root rot of the last-named host (*Phymatotrichum omnivorum*) [*R.A.M.*, xvi, pp. 176, 672] in the Houston Blackland soils of central Texas from 1928 to 1936. Four-year rotations of cotton with maize, sorghum, oats, or wheat, however, resulted in a consistent reduction of infection, over 100 per cent. more of which occurred in the continuous than in the alternating stands. Small increases in lint yield were also obtained from cotton in three- and four-year rotations. A high early- or mid-season incidence of severe root rot causes marked yield decreases, but fair harvests may be secured in continuous cotton even in the presence of the disease pro-

vided the soil is fertile and attacks of the fungus are delayed until late in the season. The number and viability of the sclerotia, the primary means of propagation of *P. omnivorum*, were not reduced in the triennial rotations as compared with continuous cotton but declined markedly in the four-year alternation. Control of root rot should be based, in accordance with the foregoing data, on the exclusion of susceptible crops from the rotation for at least three years before replanting the land with cotton, and on measures, e.g., green manuring, calculated to enhance soil fertility.

ANDREWS (F. W.). **Investigations on black-arm disease of Cotton under field conditions. II. The effect of flooding infective Cotton débris.**—*Emp. J. exp. Agric.*, v, 19, pp. 204–218, 10 graphs, 1937.

This further paper on the author's investigations into the control of blackarm disease [*Bacterium malvacearum*: *R.A.M.*, xvi, p. 247] of cotton in the Gezira area of the Sudan gives an expanded account of work already noticed from other sources [ibid., xiv, p. 757; xvi, p. 173]. The results obtained are considered to justify the flooding of old cotton land, combined with later sowing, in small, severely infected areas.

KRUG (H. P.). **Fusarium como causador da murcha do Algodoeiro no Brasil.** [*Fusarium* causing Cotton wilt in Brazil.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 319–321, [1937].

The species of *Fusarium* causing cotton wilt in Brazil is stated to have been identified by H. W. Wollenweber as *F. vasinfectum* form 1 [cf. *R.A.M.*, xvi, p. 607].

BRUCKHAUS (W.). **Some common antiseptics for the prevention of mildew on Cotton goods.**—*Appreturztg*, xxviii, pp. 35–37, 1936. [German. Abs. in *Chem. Abstr.*, xxxi, 21, p. 8205, 1937.]

Sulphur dioxide, although effective against mildew [including *Aspergillus* and *Penicillium* spp.] in cotton materials [*R.A.M.*, xv, p. 790], must be rejected on account of its possible oxidation to sulphuric acid; lead, mercury, and arsenic compounds are inapplicable by reason of their poisonous character, while copper and iron sulphates are unsuitable because of their colour and sensitivity to alkalis. Aluminium salts are efficacious only at relatively high concentrations. Chromium and manganese compounds are strongly antiseptic but their high colour is again objectionable, while a similar drawback applies to picric acid. The odour of creosote precludes its use and tannin does not kill the mildew fungi. In the case of salicylic acid and its salts the neutral dressings used must be considered, as well as the action of these compounds on certain dyes. Formaldehyde and paraformaldehyde are used with good results, while the fungicidal action of chloramine is limited.

MÉTALNIKOV (S.). **Utilisation des spores dans la lutte contre les insectes nuisibles.** [The utilization of spores in the campaign against noxious insects.]—*C.R. Soc. Biol., Paris*, cxxv, 23, pp. 1020–1023, 1 fig., 1937.

After briefly summarizing the successful results of his work in the

control of maize, cotton, and kitchen-garden pests by means of the application of dried bacterial spore emulsions [*R.A.M.*, xv, p. 292], the writer refers to recent experiments in France in which a reduction of nearly 90 per cent. in the incidence of *Pyralis* [*Sparganothis pilleriana*] and *Cochylis* [*Clysia ambiguella*] on vines was obtained by similar methods, while all the Tortricid larvae on apple trees were destroyed by the treatment. The spores remain in an active state for many years and may be applied with the utmost facility.

Drechsler (C.). **Some Hyphomycetes that prey on free-living terricolous nematodes.**—*Mycologia*, xxix, 4, pp. 447–552, 18 pl., 1937.

This is a detailed and fully illustrated account of the author's studies in pure culture of 18 species of Hyphomycetes that prey on nematodes living free in the soil in the United States [cf. *R.A.M.*, xiv, p. 508; xv, p. 720], namely: *Arthrobotrys superba* Corda, *A. cladodes* n.sp., *A. oligospora* Fres., *A. conoides* n. sp., *A. musiformis* n.sp., *A. dactyloides* n.sp., *Dactylella bembicodes* n.sp., *D. ellipsospora* Grove, *D. asthenopaga* n.sp., *D. lysipaga* n.sp., *D. leptospora* n.sp., *D. gephyropaga* n.sp., *D. brochopaga* n.sp., *Dactylaria thaumasia* n.sp., *D. candida* (Nees) Sacc., *D. polycephala* n.sp., *Tripospora aphanopaga* n.sp., and *Trichothecium polybrochum* n.sp. English and Latin diagnoses of all the new species are appended. A description (with diagnoses) is also given of another new species of *Dactylella* (*D. tenuis*) which occasionally developed in old nematode-infested agar plate cultures, following the addition of leaf mould, and which was occasionally found parasitizing oospores of *Pythium butleri* and *P. ultimum*, but was not seen to attack nematodes.

Katsura (S. K.) & Johnson (A. G.). **The green muscardine fungus on the periodical Cicada.**—*Science*, N.S., lxxxvi, 2223, p. 128, 1937.

Nymphs of the periodical cicada (*Magicicada septendecim*) in Maryland were found in May, 1936, to be covered with a creamy-white mycelium which made profuse growth on potato dextrose and nutrient beef agar, subsequently sporulating abundantly (also on rice kernels and on diseased insects in Petri dish moist chambers). The olive-green spores measured 7·8 to 12·8 by 1·8 to 4·5 μ (mostly 9·7 to 11·3 by 3 to 3·8 μ) and are thus apparently referable to the long-spored form (f. *major*) of *Metarrhizium anisopliae* [*R.A.M.*, xvi, pp. 37, 153]. Healthy nymphs and adults were successfully inoculated with spores of the fungus which was readily reisolated; the nymphs were more susceptible than the adults, on which the organism did not sporulate.

Shahan (M. S.). **A dermatomycosis of Guinea-pigs.**—*Arch. Derm. Syph., Chicago*, xxxvi, 2, pp. 335–341, 4 figs., 1937.

Particulars are given of an epidemic of dermatomycosis among laboratory guinea-pigs, caused by a fungus tentatively referred by Vera K. Charles to *Achorion gypseum* [*R.A.M.*, xvi, p. 101].

Davis (C. L.), Stiles (G. W.), & McGregor (A. N.). **Pulmonary coccidioidal granuloma. A new site of infection in cattle.**—*J. Amer. vet. med. Ass.*, xci, 2, pp. 209–215, 3 figs., 1937.

From 1918 to 1935 twenty-two cases of coccidioidal granuloma

(*Coccidioides immitis*) [*R.A.M.*, xvi, p. 745] were reported in animals in the United States, all except two originating in California [ibid., xv, p. 221]. During these years there was no marked increase in the incidence of the disease in animals, but from 1st June, 1931, to 1st July, 1936, the number of human cases rose from 264 to 450, of which 224 were fatal. The present paper deals with the detection of the fungus in two lots of Herefords in May, 1937, 42 out of 128 being affected in the first and 5 out of 61 in the second lot. The tissues involved were the mediastinal and bronchial lymph nodes and the lungs, the last-named being here recorded for the first time as a site of infection in livestock. The fungus occurred *in situ* exclusively in the spherical form, frequently enclosed in giant cells. On meat infusion agar at 37° C. white, cottony colonies were formed.

Alfonso y Armenteros (J.) & Hernandez (A.). **Tinea of the scalp in Cuba.**—*Urol. cutan. Rev.*, xli, 6, pp. 448–453, 8 figs., 1937.

The writers summarize their etiological, mycological, clinical, and therapeutic observations on tinea of the scalp in Cuba, where 90 to 95 per cent. of the cases, as in other Latin-American countries, are associated with *Microsporon felineum* [*R.A.M.*, xvi, pp. 383, 810].

Berde (K. v.). **Eine neue Abart der Trichophyton gypseum-Gruppe: Trichophyton gypseum subfuscum.** [A new variety of the *Trichophyton gypseum* group: *Trichophyton gypseum subfuscum*.]—*Arch. Derm. Syph., Berl.*, clxxvi, 1, pp. 1–4, 3 figs., 1937.

In 1929, and again during the past few years, the writer isolated from the skin of persons coming into contact with domestic animals in Hungary a new variety of *Trichophyton gypseum*, named *subfuscum*, differing from the type in the production on standard media of yellow to brown colonies in which the characteristic radial grooves are replaced by a concentric development.

Lecoulant (P.). **Kérion de Celse dû à Microsporon gypseum atypique (complément d'étude).** [Kerion celsi due to an atypical *Microsporon gypseum* (completion of study).]—*Ann. Derm. Syph., Paris*, Sér. V, viii, 8, pp. 638–646, 7 figs., 1937.

Supplementary data are presented on an atypical form of *Microsporon* [*Trichophyton*] *gypseum*, previously described (*Ann. Derm. Syph., Paris*, v, p. 760, 1934; *J. Méd. Bordeaux*, [cxii], p. 462, 1935) as *M. g. burdigalense*. In the case under discussion the fungus was responsible for kerion celsi in a four-year-old girl, while in the three previously reported it assumed the form of circinate herpes. On Sabouraud's agar the colonies grow rapidly and by the 15th day a powdery coating is formed with an acuminate centre and radial periphery, the colour of unbleached linen or chamois leather. On a glass slide the spindles germinate rapidly, giving rise to vigorous colonies covered with a powdery coating composed of a mass of spindles borne at the hyphal tips. Scattered aleuria may be present, especially in old cultures. The radial grooves, central hollow, and peripheral protuberances typical of *T. gypseum* are entirely absent.

Downing (J. G.), Nye (R. N.), & Cousins (S. M.). **Investigation of the fungous flora of apparently normal skins.**—*Arch. Derm. Syph., Chicago*, xxxv, 6, pp. 1087–1092, 1937.

Among the organisms isolated from three sites—behind the ears, the corners of the mouth, and between the toes—in 100 persons with apparently normal skin were *Epidermophyton floccosum* and *Trichophyton mentagrophytes*, besides a number of species, mostly unidentified, of various other genera.

Langeron (M.). **Nouvelles observations statistiques et mycologiques sur les teignes humaines au Maroc.** [New statistical and mycological observations on human ringworms in Morocco.]—*C.R. Acad. Sci., Paris*, ccv, 8, pp. 422–424, 1937.

The writer, having now completed his studies on 1,746 isolations of ringworm fungi from 3,000 children in western French Morocco, a preliminary note on which has already appeared [*R.A.M.*, xvi, p. 458], gives further particulars as to the geographical distribution of the species encountered, namely, *Trichophyton violaceum*, *T. glabrum*, *Achorion schoenleini*, *A. milochevitchi*, *A. debueni*, *A. brumpti*, *A. pittalugai*, and *A. talicei*. On the one hand, the well-marked association of certain species with given localities appears to be correlated with the physical geography of the region (maritime and mountain influences), and on the other with the ethnographical attributes of the native populations in the various districts surveyed.

Fujii (S.). **Beiträge zur Studie des Pilzerregers von Parau-Tamushi Takasugi und Ponape-Tamushi Takasaki.** [Contributions to the study of the fungal agent of parau-tamushi Takasugi and ponape-tamushi Takasaki.]—*Jap. J. Derm. Urol.*, xlii, 2, pp. 49–53, 8 figs., 1937.

A fungus isolated by Dr. Iseki from four cases of the forms of dermatosis known in Japan as 'ponape-' or 'parau-tamushi' (*Acta derm., Kyoto*, xxiv, 4, 1934) was identified, on the basis of its cultural and morphological characters, as *Sabouraudites ruber* [*Trichophyton rubrum*: *R.A.M.*, xvi, p. 675]. The clavate or piriform spores of the fungus measure 4 to 5 by 2 to 3 μ or 15 by 10 μ (the latter situated on the lateral branches), the 4- to 5-septate spindles 30 to 50 by 15 to 20 μ, and the chlamydospores 10 to 20 μ; 'comb tooth' elements are sparsely produced.

Pisacane (C.). **Contributo allo studio delle epidermomicosi acromizzanti.** [A contribution to the study of the decolorizing epidermomycoses.]—*Boll. Sez. reg.* (*Suppl. G. ital. Derm. Sif.*), xv, 2, pp. 190–191, 1937.

Most of the 20 cases of the decolorizing form of pityriasis versicolor investigated by the author in Italy of recent years were due to *Microsporon* [*Malassezia*] *furfur* [*R.A.M.*, xvi, pp. 316, 456], but in one instance *Hemispora stellata* [ibid., xvi, p. 385] was isolated from the infected skin.

Repetto (E.). **Ricerche sperimentali sulle lesioni della vescica da ifomiceti.** [Experimental studies on bladder lesions due to Hyphomycetes.]—*Arch. ital. Chir.*, xlv, 2, pp. 101–128, 14 figs., 1937.

In experimental inoculations with *Mycotorula zeylanoides* Red. & Cif. [*R.A.M.*, xiv, p. 582] and *M. verticillata* Red. & Cif., isolated in Italy from tonsillar and pharyngeal lesions and from erythematodesquamating dermatitis, respectively, on 24 rabbits through various channels only six developed nodular-granulomatous lesions of the bladder directly attributable to these organisms, and in four of the affected animals the injections were made directly into the bladder. It would thus appear that the bladder possesses a considerable degree of natural resistance to fungal invasion.

Baldacci (E.). **Revisione delle specie di Corethropsis e Paecilomyces isolate dall'uomo.** [A revision of the species of *Corethropsis* and *Paecilomyces* isolated from man.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 25 pp., 14 figs., 1937. [Latin and English summaries.]

After reviewing the literature of the genus *Corethropsis* the author describes his studies on the cultural and morphological characters of *C. hominis* (Vuillemin's strain) [*R.A.M.*, ix, p. 244], *C. hominis* var. *sphaeroconidica* Cif. & Bald., and *C. puntonii* Vuill., as a result of which he retains the first two in *Corethropsis*, but confirms the transference of the third to *Paecilomyces* as *P. puntonii* (Vuill.) Nannizzi. The genus *Corethropsis* in the sense attributed to it by Corda includes heterogeneous species and the author would accordingly segregate the synnematous stilbaceous forms as *Gibellula*, the type species being *G. pulcra*, and leave the non-synnematous forms belonging to the Mucedinaceae in *Corethropsis* [Corda emend.] Sacc. emend. Vuill., the type species being *C. hominis* Vuill. The paper concludes with revised diagnoses in Latin of the genera *Gibellula*, *Corethropsis*, and *Paecilomyces*.

Greenburg (W.). **Sporotrichosis: report of a case in California.**—*Arch. Derm. Syph., Chicago*, xxxvi, 2, pp. 355–357, 1 fig., 1937.

A pleomorphic species of *Sporotrichum*, presenting in culture the characters both of *S. schenckii* [*R.A.M.*, xvi, p. 608] and *S. beurmanni* [ibid., xvi, p. 254], according to the site of isolation, was found to be responsible for a deep, granulating, indurated ulcer on the median finger of the right hand of a six-year-old Mexican girl in California.

Valentine (G. M.). **Mould penetration in New Zealand cheese.**—*N.Z. J. Agric.*, lv, 2, pp. 89–99, 1937.

A brief account is given of experiments which were made to determine the causes of the development inside New Zealand cheese of mould [? *Penicillium*] seams, a defect which in 1936 brought a number of complaints and claims for refunds from English importers of the produce. The results indicated that rough handling of the cheese in storage or transit is not responsible for the condition, and that the mould seams develop chiefly in cheeses with defective rinds in atmospheres favourable to the development of the organisms. The trouble may be avoided by improving the conditions in the curing-room, especially as regards ventilation.

Ocfemia (G. O.). **The Abacá-disease situation in Davao.**—*Philipp. Agric.*, xxvi, 3, pp. 229–236, 2 figs., 1937.

As a result of his visit of investigation to the abacá [*Musa textilis*] plantations in Davao, Philippine Islands, where a suspected 'new' disease of the crop occasioned alarm in the early part of 1937, the writer concludes that the trouble is of complex origin, due to the combined effects of a disease resembling banana wilt (*Fusarium oxysporum* f. 3) [*F. oxysporum cubense*: *R.A.M.*, ix, p. 785], stem weevil (*Odoiporus* sp.) invasion, and other obscure factors. The wilt-like disease is destructive only at high altitudes where the insect is abundant. Bunchy top [ibid., xv, p. 80] is an important disease in the locality and is further aggravated by a disorder resembling mosaic [ibid., xiv, p. 811], the possible connexion of which with a similar mottling of *Canna indica* is under investigation.

Uppal (B. N.) & Kulkarni (N. T.). **Studies in Fusarium wilt of Sann-Hemp. I. The physiology and biology of Fusarium vasinfectum Atk.**—*Indian J. agric. Sci.*, vii, 3, pp. 413–442, 1 graph, 1937.

A detailed study [which is fully described] of the wilt disease of sann-hemp (*Crotalaria juncea*) caused by *Fusarium vasinfectum* [*R.A.M.*, xv, pp. 482, 771] in the region of the Bombay-Deccan canals showed that the disease is widespread, that it greatly reduces the yield of green dressing per acre, and consequently is a serious menace to sugar-cane cultivation by the Manjri standard method in which sann-hemp and cotton form a normal rotation.

The first symptom in the field consists of a yellowing of the oldest leaves, which proceeds upwards, the vascular tissue of the petiole at the same time turning brown. Young seedlings, if infected, may die within a few hours of emergence, older plants collapsing in two to three weeks. Wilting is very rapid in September and October, but gradual in June and July.

Isolations of *F. vasinfectum* from wilted sann-hemp in widely separated localities in Bombay were almost equally pathogenic to sann-hemp. The best vegetative growth of the fungus in culture occurred at 25° to 30° C., and the disease also showed maximum development at a similar soil temperature range. Infection was very destructive in soil with a low moisture content (15 per cent.), but as soil moisture does not vary widely under normal field conditions during the monsoon soil temperature is generally the limiting factor determining severity. On sann-hemp the fungus produced emulsin, lipase, erepsin, trypsin, and amidase, but was unable to utilize cellulose or starch. In media containing inorganic nitrogen the fungus reduced nitrates to nitrites, but such action was not noted in media with organic nitrogen. The filtrates of 24- to 28-day-old cultures on Richards's solution contained 0·0015 to 0·0022 mg. of nitrite nitrogen per c.c. of solution, and possessed toxic qualities which were not destroyed by boiling.

In cross-inoculation experiments infection was transferred from *C. juncea* to *C. anagyroides*, *C. striata*, and *C. usaramoensis* but not to pigeon pea (*Cajanus indicus*) [*C. cajan*] or cotton. Experimental evidence showed that the disease in sann-hemp is seed-borne, generally

externally, though a small percentage of the seed may carry internal infection as dormant mycelium (118 seedlings from 8,786 seeds sown showed internal browning and *F. vasinfectum* was recovered from the discoloured portions). Infection of pods from peduncles often results in retarded development; seeds formed in such pods often carry infection internally, and are an important source of transmission.

MITRA (M.). **An anthracnose disease of Sann-Hemp.**—*Indian J. agric. Sci.*, vii, 3, pp. 443–449, 4 pl., 1937.

An account is given of the author's studies of the serious anthracnose of sann-hemp [*Crotalaria juncea*] seedlings, which was first noticed in 1935 in Pusa in fields sown during August, when the weather was constantly wet and cloudy, and especially in thickly sown stands. Infection usually occurred on the cotyledons, from which it spread to the stem and growing point, the young seedlings generally dying when the latter was reached. In plants infected at a later stage of growth, the disease was restricted to spots on the leaves and stems, and the plants for the most part recovered on the onset of dry and bright weather. Isolations yielded a fungus which was grown in pure culture and identified as a strain of *Colletotrichum curvatum* [*R.A.M.*, xv, p. 703]. Infection experiments showed that it is very virulent to *Crotalaria juncea* seedlings, especially if sown late when the weather is moist and cloudy. Further pot experiments indicated that disinfection of both naturally and artificially infected seed with 0·25 per cent. uspulun for 30 minutes completely controlled the disease, and that spraying the seedlings in dry weather before infection with 0·5 per cent. Bordeaux mixture, 1 per cent. Burgundy mixture, or 1 in 10,000 malachite green solution plus 0·1 per cent. agral, was effective in reducing the percentage of infection and retarding the attack by the fungus.

BENATAR (R.). **Contribução ao estudo bibliographico de doenças da Roseira.** [Contribution to the bibliographical study of the diseases of the Rose.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 239–264, [1937].

This paper is divided into two parts, the first of which consists of an alphabetical index of 278 species of fungi and three species of bacteria recorded on the rose, with citations, and the second part comprises a list of 168 papers relating to the rose diseases, arranged alphabetically under the authors' names.

MCWHORTER (F. P.). **A latent virus of Lily.**—*Science*, N.S., lxxxvi, 2225, p. 179, 1937.

The occurrence of a 'latent' virus in lilies (*Lilium tigrinum*, *L. candidum*, and *L. longiflorum*) is reported from Oregon. The infective principle is apparently identical with the colour-removing tulip virus 1 [*R.A.M.*, xii, p. 292] which plays the leading part in the complex disturbance known as 'breaking' [ibid., xv, p. 724] and is believed to date back to 1576 (*Nat. hort. Mag.*, xii, p. 179, 1933). Inoculations during the past three years from externally sound bulb-perpetuated lilies to Clara Butt and other tulip varieties have induced extreme forms of breaking. Tulips have, in fact, proved to be remarkably

efficient test plants for determining the presence of viruses in *L.* spp. The juice from seedlings of the fertile *L. longiflorum* was found not to contain the latent virus, and bulb-perpetuated lilies should, therefore, not be planted among choice seedling varieties. These facts, which are to be further elaborated in a forthcoming paper, may necessitate a reconsideration of tulip breaking as the oldest known virus disease, since it is by no means impossible that the wild or semi-wild tulips introduced into Europe from Turkestan were healthy until exposed to infection from Madonna lilies in Italian gardens.

Gregory (P. H.). **Narcissus leaf diseases.**—*Daffodil Yearb., 1937*, pp. 46–52, 4 pl., 1937.

Popular notes, designed to assist growers, are given on the symptoms and control of the following common leaf diseases of narcissus in Great Britain. Scorch (*Stagonospora curtisii*) [*R.A.M.*, xiv, p. 366; xv, p. 298] is widely prevalent and is an important cause of spotted, spoiled flowers in localities where flowering occurs early. The fungus appears to be carried on the nose of the bulb [ibid., xiii, p. 167] where overwintered spores infect the new, emerging shoot. The disease can occur in newly planted stocks, but generally its severity is increased after the first year. The Trumpet and Incomparabilis forms remain comparatively free from epidemic infection on the foliage and from flower-spotting. Among the most susceptible varieties in early-flowering districts in south-western England are Soleil d'Or, Scilly White, Grand Primo, Bath's Flame, Cheerfulness, and Horace. A wet growing season and excessive applications of nitrogenous manures increase attack on the foliage and flowers. Copper sprays check spread from the infected leaf tips, but the best control results from picking these off as early as possible.

White mould (*Ramularia vallisumbrosae*) [ibid., xvi, p. 319] first appears in Cornwall and the Scilly Isles on the Golden Spur variety, which acts as a reservoir of infection for other varieties. Narcissus fire (*Botrytis polyblastis*) [ibid., xiv, p. 637] occurs irregularly, except in the south-west where it causes spotting and decay of the flowers in wet weather and, later, rapid destruction of the foliage. It does not produce bulb rot. The varieties worst affected early in the season are those of *N*[*arcissus*] *tazetta* parentage, especially Soleil d'Or, but incidence is also very general on Trumpet varieties. Control consists in preventive applications of Bordeaux mixture and the destruction of diseased foliage. Grey mould or smoulder (*B. narcissicola*) [ibid., xiv, p. 366] is widely distributed and produces rapid rotting of the perianth in early districts, epidemics on the foliage in cold, wet seasons, and rotting of stored bulbs in cool summers.

Stripe, grey disease, or mosaic (variously applied to one or more mosaic-like conditions) [ibid., xv, p. 444] is common on most cultivated varieties of narcissus, few stocks, probably, being completely free from it, while in some varieties nearly every plant may be affected. A perennial disease in the bulb, it usually spreads slowly through the stock in a manner at present imperfectly understood. Many varieties are only slightly affected, but in others it seriously reduces plant vigour. The streaks vary from dark grey-green to yellow-green, and in some varieties, such as Minister Talma, to bright yellow. Stripes are common in

the perianth also. It sometimes causes an overgrowth of the cells, with resultant roughening of the leaf surface, a condition always present in striped Czarina plants. The only control method known is roguing.

Foliage wilt in bright weather is often a sign of root rot, due, presumably, to insufficiency of the root systems. Grassiness, i.e., the presence of numerous narrow leaves, is a symptom of excessive splitting of the bulb, usually following injury to the basal plate, probably caused by narcissus fly [*Merodon equestris* and *Eumerus* spp.] and bulb-rotting fungi.

Murphy (P. A.). **Irish Free State: a new outbreak of Peronospora antirrhini in the country.**—*Int. Bull. Pl. Prot.*, xi, 8, p. 176, 1937.

The author states that 50,000 *Antirrhinum majus* plants were destroyed in 1936 in a nursery at Carlow, Ireland, by an outbreak of *Peronospora antirrhini* [*R.A.M.*, xvi, p. 815], and that, in spite of the steps that were taken immediately to eradicate the disease, it again appeared on a few plants in that nursery towards the end of the 1937 season. The first symptom is the appearance of indefinite pale areas on the leaves, bearing a fine, almost invisible whitish mildew on the lower surface; in most cases, the growing points of the seedlings are killed back, and the lower leaves then wither from the tip backwards. The conidiophores of *P. antirrhini* are 250 μ high, and bear hyaline, oval conidia, 26 by 17·5 μ. The fungus survives by means of resting spores, 30 μ in diameter, which are formed in the leaves. There was evidence that, if the disease is controlled during the seedling stage, the plants may grow and flower almost normally.

Nicolas (G.) & Aggéry [Berthe]. **Une maladie bactérienne d'Aucuba japonica Thunb.** [A bacterial disease of *Aucuba japonica* Thunb.]—*Bull. Soc. Hist. nat. Toulouse*, lxx, pp. 267–272, 3 figs., 1936. [Received 1937.]

Since 1932 *Aucuba japonica* plants at the Toulouse Faculty of Sciences have been affected by a disease involving stunting, malformation, a yellowish discoloration, and a brown to black spotting of the tips and edges or the entire surface of the leaves, some of which may be completely shrivelled and adhere to the branches. The floral bunches do not expand and the flowers remain in the bud stage and wither before opening. Diseased leaves are frequently blistered and abnormally thick, the young ones containing an abundance of starch. From the juice of diseased leaves a rod-shaped, Gram-positive bacterium was isolated, measuring 6 to 7 by 2 to 2·5 μ and forming creamy-white, stellate colonies; gelatine was not liquefied. The organism has not yet been studied systematically, but is obviously distinct from *Pseudomonas aucubicola* associated with a disease of *A. japonica* in Scotland [*R.A.M.*, xv, p. 510].

Obee (D. J.). **A note on the canker disease of Gardenias.**—*Trans. Kans. Acad. Sci.*, xxxix (1936), pp. 103–104, 1937.

A species of *Phomopsis* with a floccose, concentric mycelium, fairly large pycnidia, and elliptical-ovoid spores, has been isolated from gardenias in a greenhouse at Kansas University. The fungus would

appear to be distinct from those isolated, respectively, by Hansen and Scott in California and by Tilford in Ohio [*R.A.M.*, xvi, p. 614]. The Kansas strain produces corrugated cankers, originating as greenish-brown spots, on the stems which are entirely girdled. The leaves of affected plants turn yellow and shrivel and commonly fall, while the flower buds are frequently shed before opening. Of the three varieties under observation, Californiae is the most susceptible, followed by Belmont, while Veitchii is comparatively resistant. The spread of infection may be arrested by painting the stems of the healthy plants with semesan at 10- to 14-day intervals.

Chester (F. D.). **A bacterial disease of Delphinium.**—*Phytopathology*, xxvii, 8, pp. 855–858, 1937.

A full description is given of the morphological, cultural, and physiological characters of *Erwinia phytophthora*, which has been identified as the agent of the bacterial disease of *Delphinium ajacis* described by B. O. Dodge from the New York Botanic Garden [*R.A.M.*, xv, p. 229]. Inoculations with the organism on healthy plants gave positive results.

Gill (G. A.). **Diseases of Lucerne.**—*Bull. Dep. Agric. S. Afr.* 170, pp. 81–83, 1936. [Received November, 1937.]

Notes are given on the following diseases of lucerne in South Africa, viz., rust (*Uromyces striatus*) [*R.A.M.*, xvi, p. 754], leaf spot (*Pseudopeziza medicaginis*) [ibid., xiv, p. 424], anthracnose (*Colletotrichum trifolii*) [ibid., xiii, p. 773; xvi, p. 540], downy mildew (*Peronospora trifoliorum*) [ibid., xv, p. 373], crown rot (*Fusarium* sp.) [cf. ibid., xv, p. 158], grey mould due to *Physarum cinereum* [ibid., xii, p. 697], wilt (*Rhizoctonia crocorum*) [*Helicobasidium purpureum*: ibid., xv, p. 776], stem spot due to a *Phoma*, stem spot due to *Pleospora vulgatissima*, and the production of white shoots attributed to physiological disturbance.

Of these diseases the first two are locally the most important. Rust is found in every province of the Union, and is probably the most destructive of all lucerne diseases in South Africa, being especially severe in damp seasons. When extensive infection is present the crop should be mown or grazed even if not mature, and with changed weather conditions the next cutting will probably be healthy. Leaf spot is also induced by unfavourable conditions, and the same recommendation is made. Anthracnose has been reported from the Cape and the Transvaal, but is not common; affected plants should be dug out and destroyed. Downy mildew is widespread but not usually very harmful; the affected crop should be cut. Crown rot is moderately prevalent in the Transvaal, where it is suspected to cause much damage under favourable conditions; in affected areas drainage and cultural methods should be improved and precautions taken against the carrying of infection in the irrigation water to lower ground. In severe cases rotation is recommended. The remaining diseases are of minor importance.

Willis (L. G.) & Piland (J. R.). **A response of Alfalfa to borax.**—*Science*, N.S., lxxxvi, 2225, pp. 179–180, 1937.

Several instances of crop responses to borax have been observed in

North Carolina soils with a high hydrogen-ion concentration and an abundance of calcium salts. Romaine [lettuce], for instance, was practically cured of symptoms that have been considered typical of manganese deficiency by the application to the soil of borax at the rate of 4 lb. per acre. Recently a problem involving lucerne production has become acute. The terminal leaves of the plants turn yellow, the apical buds do not develop normally, extensive wilting occurs in dry weather, while severe aphid and leafhopper infestation is also a feature of the trouble. The soil in which this condition was first noticed had been heavily limed. Borax (5 lb. per acre in March) effectively corrected the disorder during the same season [*R.A.M.*, xvi, p. 680], but a similar treatment applied late in May did not operate until the following year, possibly on account of photoperiodic factors. Manganese appears to supplement the effect of borax, while zinc is antagonistic and the influence of copper negligible. The disorder, which appears to be generally prevalent, corresponds in all respects to the supposedly transmissible lucerne yellows [ibid., x, p. 192].

Fischer (G. W.). **Observations on the comparative morphology and taxonomic relationships of certain grass smuts in western North America.**—*Mycologia*, xxix, 4, pp. 408–425, 18 figs., 1937.

Details are given of the author's comparative studies of the morphology of the smuts of barley grasses (*Hordeum* spp.), brome grasses (*Bromus* spp.), and wheat grasses (*Agropyron* spp.) in the American north-west, which had hitherto been ascribed to *Ustilago lorentziana*, *U. bromivora*, and *U. bullata* [*R.A.M.*, xvi, p. 517], respectively. The examination of 19 current collections and 41 herbarium specimens of the smuts showed that they are morphologically similar, variations in the size of the chlamydospores and in the nature of their epispores being wider in the various collections of *U. bromivora* than between the chlamydospores of this species and those of either of the other two species. It is therefore considered that the three smuts really belong to one composite species which should be known by the earliest name *U. bullata*. An emended description of the species is given and a list is appended of 37 grasses, comprising five species of *Agropyron*, 23 of *Bromus*, one of *Elymus*, seven of *Hordeum*, and one of *Sitanion*, which are recognized as hosts of *U. bullata*; of this total, ten species are reported for the first time.

Hopkins (J. C. F.). **A programme for the control of diseases of Apple trees in Southern Rhodesia.**—*Rhod. agric. J.*, xxxiv, 8, pp. 619–630, 1 pl., 1937.

In view of the increasing importance of deciduous fruit planting in Rhodesia the author briefly describes the symptoms, life-histories, and control of the chief diseases of apples, viz., mildew (*Podosphaera leucotricha*) (sometimes very severe on susceptible varieties at elevations up to 4,000 ft. and found even at 7,000 ft.), black rot (*Physalospora cydoniae*) [*P. obtusa*: see next abstract], bitter rot (*Glomerella cingulata*), and blister and fruit cracking (*Coniothecium chomatosporum*) [*R.A.M.*, xv, p. 586]. The last three can be controlled by improved orchard sanitation, while the schedule recommended for mildew consists in removing

and destroying or digging in all diseased material during the dormant period, applying a dormant spray of lime-sulphur 1 in 20 + miscible oil, an application of lime-sulphur 1 in 30 between open cluster and pink bud, and one of sulphur dust or lime-sulphur 1 in 100 (with colloidal sulphur, 1½ lb. per 100 galls., or wettable sulphur, 8 lb. per 100 galls. added) at petal fall, again two weeks later, and subsequently at monthly intervals if necessary. Other fungi attacking apples in Rhodesia are *Schizophyllum commune* [ibid., xvi, p. 154], *Diaporthe perniciosa* [ibid., xv, p. 555], *Valsa leucostoma* [ibid., xv, pp. 283, 447], *Corticium salmonicolor*, *Armillaria mellea*, *Leptothyrium pomi*, and *Venturia inaequalis*.

The paper concludes with notes on the selection of the right types of spray materials and equipment.

FOSTER (H. H.) **Studies of the pathogenicity of Physalospora obtusa.**—*Phytopathology*, xxvii, 8, pp. 803–823, 3 figs., 4 graphs, 1937.

Almost ideal conditions for the initiation of apple leaf infection by *Physalospora obtusa* [*R.A.M.*, xvi, pp. 21, 335] were found to be provided by a 24-hour period in a moist chamber at 20° C. Seven isolates, five of them monosporous, were used in leaf infection studies on nine varieties. Nos. 8, 8a, and 9, originating from (1) apple fruit in Maine, (2) a single spore from a culture of the foregoing, and (3) from quince in France, infected all the varieties used, 12a (single spore from apple leaf) attacked Rome Beauty, Mammoth Black Twig, and Northwestern Greening, 19a (single spore from apple fruit) was pathogenic to Rome Beauty, Fameuse, Ben Davis, and Northwestern Greening, while 15a and 18a (single spores from Kalbas pear in South Africa and apple fruit in Wisconsin, respectively), caused no macroscopic symptoms on any of the test varieties. Only 10 out of 27 isolates from different parts of the United States used in inoculation experiments on Northwestern Greening and Yellow Transparent apple foliage gave positive results; nine of these strains originated in Maine, Massachusetts, or Virginia, and only occasional sparse infection was produced by material from the upper Mississippi Valley region.

Macroscopic symptoms of infection by isolate 8a of *P. obtusa* on Northwestern Greening and Yellow Transparent became apparent on trees kept at a temperature range of 12° to 28° C., the maximum incidence occurring at 20°. An eight-hour period in the moist chamber at a temperature of 20°, following inoculation with 8a and 9b (single spore from the French quince culture) on Northwestern Greening and with the former only on Yellow Transparent, was the minimum required for the initiation of infection, and it is thought that in nature 12 to 16 hours of favourable moisture and temperature conditions result in considerable infection. The minimum incubation period of the isolates consistently inducing infection ranged from 20 to 96 hours. Lesions were more numerous and showed a stronger tendency to coalesce on young, actively growing leaves than on more mature foliage. Mature pycnospores usually developed within one to two weeks from immature pycnidia on leaves placed over moistened filter-paper in Petri dishes.

Of 22 apple varieties tested in 1934 and 1935 for their reaction to isolates 8a and 9b, none proved to be absolutely immune, but a fair

degree of resistance was shown by Virginia crab, Rome Beauty, and Mammoth Black Twig.

Evidence of stomatal penetration, chiefly on the dorsal surface, was furnished by the examination of inoculated leaf material of Yellow Transparent, Northwestern Greening, Wealthy, and other varieties decolorized and then cleared in saturated chloral hydrate solution. No definite correlation was detected, in inoculation tests on Jonathan, Northwestern Greening, and Winesap, between the amount of frog-eye leaf spotting and black rotting of the fruit induced by the different isolates of *P. obtusa*.

Mehta (P. R.). **A fruit rot of Apples caused by a species of Rhizopus.**—*Curr. Sci.*, vi, 2, pp. 58–59, 1 fig., 1937.

Apples received from Quetta were affected by a soft rot, causing a russet- to verona-brown discoloration of the skin which easily peeled away from the underlying tissue. The fruit emitted a slightly sour odour and the zinc-orange-coloured pulp was readily detachable from the tissues of the core. No fungal growth was apparent on the surface, but the seeds bore mycelium. A *Rhizopus* of the *arrhizus* group was isolated from the affected material with sporangiophores mostly 160 to 480 μ long, globose sporangia 80 to 176 (mostly 100 to 112) μ in diameter, and slightly angular, faintly striated, sometimes hyaline spores 5 to 7·2 μ in diameter. Growth took place at 10° to 40° (optimum 37°) C., and sporangial formation at 15° to 40°. Inoculation of slightly wounded, ripe and unripe apples resulted in rotting, which was slow from 15° to 23°, but very rapid from 32° to 38°.

Hildebrand (E. M.) & Heinicke (A. J.). **Incidence of fire-blight in young Apple trees in relation to orchard practices.**—*Mem. Cornell agric. Exp. Sta.* 203, 36 pp., 2 figs., 1937.

Investigations carried out at Cornell during a period of four years into the incidence of fireblight [*Erwinia amylovora*: *R.A.M.*, xvi, p. 473, and next abstracts] in an orchard of young apple trees of different varieties subjected to different soil managements and cultural practices showed that the primary conditions that must be fulfilled before an outbreak can take place are (1) temperatures favouring abundant insect activity and (2) sufficient moisture for the oozing of cankers, i.e., rainfall of over ½ in. during blossoming. The amount of annual injury was correlated to a certain extent with the amount of initial blossom infection which was common in 1932 and 1933 and relatively scarce in 1934 and 1935, the annual injury per average tree for the four years being 6·9, 9·5, 7·9, and 3·4 ft., respectively; the 7·9 ft. injury in 1934 was of less consequence to the trees than 6·9 ft. in 1932 because of the growth made in the intervening years. The least susceptible variety was Delicious, followed (in order of increasing susceptibility) by Northern Spy, McIntosh, Cortland, and Rhode Island Greening, the percentage of the trees showing over 50 ft. injury being 0·5, 3, 13, 18, and over 50, respectively. Generally speaking, shoot injury was the principal type of damage, followed by spur, branch, and body blight, but individual varieties reacted differently as regards the various types of injury. The greatest degree of susceptibility was induced by soil cultivation, lucerne

supporting a more resistant type of growth, and trees on sod being the most resistant of all. Comparing the effect of cultural methods on the tree parts affected, spur blight and shoot blight were most prevalent on trees receiving cultivation followed by those with lucerne and those on sod, whereas with both branch and body blight the sequence was cultivation, sod, and lucerne. Pruning once in three seasons affected the distribution more than the amount of injury. Spur blight was approximately half as abundant on pruned as on unpruned trees, while shoot blight was greater on pruned trees. Pruning did not appreciably affect branch blight, but the pruned trees had about nine times as much body blight as the unpruned. It reduced the total number of points of infection, but increased lineal spread. Nitrogen fertilization decreased the percentage of spurs blossoming and blighting, increased shoot blight, and decreased branch blight, but in general caused an increase in the total amount of fireblight injury. The average girth measurements for young blighted apple trees under lucerne, cultivation, and sod treatment were, respectively, 26·61, 25·6, and 24·15 cm.; if both blight and growth factors are considered, the best cultural treatment was lucerne without nitrogen. Wounds produced by ringing became infected and the operation tended to increase susceptibility the following season.

Hildebrand (E. M.). **Infectivity of the fire-blight organism.**—*Phytopathology*, xxvii, 8, pp. 850–852, 1937.

Using a modification of the micro-pipette technique for single-cell isolation devised by W. H. Wright and collaborators (*J. Lab. clin. Med.*, xii, p. 795, 1927; *J. Bact.*, xvii, p. 10, 1929), the writer transferred about 100 single cells of the fireblight organism (*Erwinia amylovora*) [see preceding and next abstracts] between 8 and 16 hours old to the stigmas, anthers, and nectaries (wounded or uninjured) of pear flowers on forced dwarf trees in the greenhouse in January and February without success. Positive results were obtained, however, in one out of two similar tests on dwarf apples when a single cell was transferred to the nectary, the closed condition of which, in contrast to the open pear nectaries [ibid., xiv, p. 370], probably prevented the desiccation liable to occur at the low relative humidities (50 per cent.) prevailing in the greenhouse at that season. In a further series of trials on excised apple flowers in moist chambers at 24° C., infection developed in 9 out of 15 single-cell inoculations into the nectaries, and positive results were also secured in 3 out of 5 cases with 2 cells, in 4 out of 5 with 5, and in all with 10 or more. Evidence was next obtained that apple nectar acts as a culture medium for single cells of *E. amylovora*, while juice extracted from pear shoots and fruits serves a similar purpose for large numbers of the organism.

These observations are considered to support the view that a single active fireblight canker may initiate a severe epidemic in an orchard, calculating that a 25-year-old tree in full bloom provides some 100,000 blossoms, for each of which potential inoculum is generated by single cells at the rate of 100,000 bacteria in 17 hours. One bee out of the many thousands in a hive may easily visit and infect the flowers on ten other trees in one of its many daily trips, so that the possibilities of

dissemination, reckoning 27 trees to the acre and presupposing the continuance of four or five days of good weather, are sufficient to cause an epiphytotic.

HSIONG (S. L.) & HILDEBRAND (E. M.). **Maternal inheritance in Pears.** —*Phytopathology*, xxvii, 8, pp. 861–862, 1937.

In reciprocal crosses between certain horticultural varieties of *Pyrus communis* (Phelps, Flemish Beauty, Pulteney, and Seckel) and Kieffer (presumed to be a hybrid between *P. communis* and *P. serotina*), made with a view to developing resistance to fireblight (*Erwinia amylovora*) [see preceding abstracts], an apparent inclination was noted towards a closer resemblance of the F_1 individuals to the seed than to the pollen parent. The results of inoculation tests with the organism on F_2 trees of the crosses showed in like manner the tendency towards maternal inheritance of resistance to the disease.

WEINBERGER (J. H.) & CULLINAN (F. P.). **Symptoms of some mineral deficiencies in one-year Elberta Peach trees.**—*Proc. Amer. Soc. hort. Sci.*, xxxiv, pp. 249–254, 2 figs., 1937.

A description is given of the symptoms produced on one-year-old Elberta peach trees grown in sand cultures with a nutrient solution lacking either nitrogen, phosphorus, calcium, magnesium, iron, sulphur, manganese, or boron.

JONES (W.). **Armillaria mellea Vahl ex Fr. on Raspberries in British Columbia.**—*Sci. Agric.*, xvii, 12, pp. 752–753, 1 pl., 1937.

During surveys in 1936 numerous Cuthbert, Viking, and Lloyd George raspberry plants in eight plantations in five districts of the Lower Mainland, British Columbia, as well as several thimbleberry (*Rubus parviflora*) plants, were found to have been partially or entirely killed by *Armillaria mellea* [*R.A.M.*, xvi, p. 564]. The fungus appears to be widely distributed in the Lower Mainland, and to be very prevalent in the woods of the raspberry-growing districts; so far, however, it has not been found in the raspberry plantations of Vancouver Island. The planting of raspberries on newly cleared land known to be infected is deprecated.

DOTTI (F.). **Influenza del solfato di rame nella lotta contro il Coryneum beijerinckii del Pesco.** [The influence of copper sulphate in the campaign against *Coryneum beijerinckii* on the Peach.]—*Pubbl. R. Ispett. Agric. Prov. Ravenna*, 25 pp., 1936. [Abs. in *Hort. Abstr.*, vii, 3, p. 225, 1937.]

Field experiments on Amsden, Morellone, and Triumph peaches attacked by *Coryneum beijerinckii* [*Clasterosporium carpophilum*] in Northern Italy [cf. *R.A.M.*, xiii, p. 706; xvi, p. 136] demonstrated the absolute efficacy of dormant treatments with alkaline Bordeaux mixture containing 3 per cent. copper sulphate and 3 per cent. lime. Three applications—the first at leaf fall, the second between the end of December and middle of January, and the third about 20 days before flowering—should suffice for moderately severe attacks, but in cases of intensive infection a fourth may be interposed.

DESLANDES (J.). **Doenças da Bananeira.** [Diseases of the Banana.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 199–206, [1937].

The author gives a preliminary account of banana diseases observed in Brazil [*R.A.M.*, xiii, p. 250; xv, p. 818] since 1931, among which the following may be mentioned. Dwarf bananas suffer from a deformation of the crown of unknown etiology, chiefly characterized by the severe stunting of the leaves, which have a more vertical habit than normal and frequently all depart from the same level on the trunk; when not completely aborted, the bunches develop poorly and for the most part are killed by the sun. A mosaic disease causing yellow, sometimes broken streaks darkening with age on the leaves was recorded in São Vicente in 1931, but does not do any damage. About the same year 'maça' [apple] bananas and other varieties of *Musa sapientum* in the province of Piracicaba were severely attacked, and have since been practically wiped out by a disease strongly resembling the Panama disease [*Fusarium oxysporum* var. *cubense*], but the causal agent of which has not yet been determined. Leaf spots are caused by a number of various fungi, including *Haplographium atrobrunneum*, *Gloeosporium musarum*, *Helminthosporium torulosum*, and *Nigrospora* sp., and end rot of the fruit by *Stachylidium theobromae* [ibid., xvi, p. 110] and *H. torulosum*. A list is also given of the fungi causing storage and transit rots of bananas shipped from Brazil, most of which have already been recorded in this *Review*.

TISSOT (P.). **La maladie de Sigatoka du Bananier.** [The Sigatoka disease of the Banana.]—*Rev. Bot. appl.*, xvii, 189, pp. 372–374, 1937.

A brief popular account is given of the symptoms, geographical distribution, and control of banana leaf spot (*Cercospora musae*) [*R.A.M.*, xvi, p. 729], not yet recorded for Africa, reference also being made to the influence of environmental factors on infection and to varietal reaction to the disease.

REINKING (O. A.). **Isolations made from heart rot of Banana in Honduras.**—*Phytopathology*, xxvii, 8, pp. 853–854, 1937.

A severe form of heart rot is stated to have been prevalent in cut-over banana plantations in Honduras in February, 1936, characterized by a brown, malodorous decay proceeding downwards from the tip of the central group of rolled young leaves, which were frequently pushed upwards in a folded mass. *Fusarium moniliforme* [*Gibberella moniliformis*: *R.A.M.*, iv, p. 569; xi, p. 353] and bacteria were isolated from some of the diseased plants [cf. ibid., v, p. 617], whereas in the Philippines the fungus associated with a similar condition of banana and abacá [*Musa textilis*] is *F. moniliforme* [*G. fujikuroi*] var. *subglutinans*, which has also been reported on bananas from Trinidad [ibid., xiii, p. 788] and Syria [ibid., xvi, p. 264]. Further studies are therefore desirable to determine the exact identity of the organism concerned in the etiology of heart rot in the various countries affected.

RANGEL (J. F.). **A podridao preta do Abacaxi.** [The black rot of Pineapple.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 329–332, [1937].

In giving a su[illegible] of the results of his investigations on black rot

(*Thielaviopsis* [*Ceratostomella*] *paradoxa*) [*R.A.M.*, xv, p. 693] of pineapple, which is stated to be one of the chief causes of the serious decline of recent years in the export of this fruit from Brazil, the author says that much of the rot could be effectively and most economically prevented by carefully avoiding during harvest unnecessary wounding or bruising of the pineapples. Experiments on control of the rot in transit and storage showed that formalin fumigations were the most effective and cheapest method, and that entry of the fungus through the cut end of the scape is effectively prevented by applications to it of paraffin wax.

Shippy (W. B.). **Flordo spray.**—*Pr. Bull. Fla agric. Exp. Sta.* 504, 2 pp., 1937.

The Flordo spray, consisting of 10 lb. soap (granular or chip form), 2½ lb. copper sulphate, and 1 qt. of 26 to 28 per cent. ammonia per 100 galls. of spray mixture, is stated to have proved an effective fungicide on various plants, especially ornamentals, in Florida during the last 8 years.

Klee (F.). **Erddämpfungs-Erfahrungen.** [Soil-steaming experiences.] —*Blumen- u. PflBau ver. Gartenwelt*, xli, 35, p. 405, 1 fig., 1937.

Details are given of the construction and application of a soil-steaming apparatus [*R.A.M.*, xvi, p. 693] consisting of a low-pressure Galloway tube boiler, fitted either with three barrels or three conical frames, inverted over gridirons to hold ½ cu. m. each of soil, the barrels being furnished with a sieve inserted a third of the way up and a set of pipes for the uniform distribution of the steam below. Potatoes at various depths in the soil served as indicators of the completion of the process, which occupied a period of 20 to 30 minutes per barrel, 16 cu. m. of soil being treated in one day.

Methoden zur Prüfung von Pflanzen- und Vorratsschutzmitteln. [Methods of testing plant and supplies protectives.]—*Mitt. biol. Anst.* (*Reichsanst.*) *Berl.*, 55, 55 pp., 53 figs., 20 diags., 2 graphs, 1937.

This valuable compilation of contributions (X to XXXIII) from specialists in various branches of phytopathology describing methods for the testing of disinfectants for the control of diseases and pests of plants and stored provisions is under the general editorship of W. Trappmann, who discusses in the opening section the principles and organization of the official trials of such preparations. A. Winkelmann deals with the testing of cereal seed-grain disinfectants against wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*], snow mould of rye (*Fusarium*) [*Calonectria graminicola*], stripe disease of barley (*Helminthosporium gramineum*), and loose smut of oats (*Ustilago avenae*); with the general principles of fungicide testing, as exemplified by the treatment of rose mildew [*Sphaerotheca pannosa*], *Fusicladium* [*Venturia*] of fruit trees, hop *Peronospora* [*Pseudoperonospora humuli*] (also described in detail by H. Hampp and J. Jehl [*R.A.M.*, xvi, p. 836]), and club root of cabbage (*Plasmodiophora brassicae*), which is also fully discussed by H. Bremer, B. Wehnelt, and E. Brandenburg; and with

the control of vineyard diseases and pests, including *Peronospora* [*Plasmopara viticola*], *Oidium* [*Uncinula necator*], and 'roter brenner' [*Pseudopeziza tracheiphila*]. H. Zillig and L. Niemeyer describe the conditions for outdoor trials of preparations for the control of *Plasmopara viticola*, while W. Staudermann supplies a comprehensive account of greenhouse methods of testing for the same purpose. The preservation of potatoes against the storage rots due to *Phytophthora* [*infestans*] and bacteria is dealt with by O. Schlumberger. J. Liese outlines the toximetric method of testing timber preservatives by means of wood blocks [ibid., xvi, p. 581].

Montemartini (L.). **La terapia interna delle piante.** [The interna therapy of plants.]—*Riv. Biol.*, xxii, 2, pp. 311–320, 1937.

This is a concise summary of recent work [most of which has been noticed in this *Review*] on the control of certain plant diseases by the introduction of the essential nutrients into the system by appropriate manurial treatment or injections.

Gonçalves (C. R.). **Considerações sobre a transmissão de doenças das plantas pelos insectos.** [Considerations on the transmission of plant diseases by insects.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 121–129, 1 pl., [1937].

This is a discussion, chiefly from the relevant literature, of the part played by various insects, in the transmission of fungal, bacterial, and virus diseases of plants in the field, together with a brief discussion of the different means by which they effect this transmission.

Wyckoff (R. W. G.). **Die Isolierung hochmolekularer Eiweissstoffe mit der Ultrazentrifuge.** [The isolation of high-molecular proteins with the ultracentrifuge.]—*Naturwissenschaften*, xxv, 30, pp. 481–483, 1937.

The writer concisely reviews his recent researches (carried out in part with W. M. Stanley and other collaborators) on the crystallization of the tobacco mosaic virus by differential ultracentrifugation, and the possible extension of this method of isolation to animal viruses, such as infectious papilloma of the rabbit, composed of particles of the same order of magnitude [*R.A.M.*, xvi, p. 778].

Smith (K. M.). **A textbook of plant virus diseases.**—x + 615 pp., 2 pl. (1 col.), 99 figs., London, J. & A. Churchill, Ltd., 1937. Price £1 1*s*.

In this valuable contribution to the diagnosis and study of plant viruses [cf. *R.A.M.*, xv, p. 107], partially based on the unpublished data of various experts in different branches of the subject, the author has adopted a modification of the classification scheme suggested by J. Johnson [ibid., xvi, p. 828], using the generic Latin name of the host instead of its popular English equivalent, partly to avoid confusion and partly on account of the wider international application of the former. The author's conception of the identification and numbering of the viruses does not coincide with that of Johnson, whose designations are included (when known) in the list of synonyms. The system followed,

then, consists in a grouping together of all those viruses chiefly associated with a particular host plant, consecutively numbered 1, 2, 3, and so forth, e.g., *Beta* virus 1 (sugar beet curly top), *Beta* virus 4 (virus yellows), *Prunus* virus 3 (phony peach), *Solanum* virus 1 (potato virus X), *Solanum* virus 14 (potato phloem necrosis), *Nicotiana* virus 11 (tobacco necrosis), and *Lycopersicum* virus 3 (tomato spotted wilt). The subject is treated uniformly throughout the work, the virus being first dealt with, its properties, mode of transmission, and other characters given, and the diseases it induces described under the various hosts arranged according to plant families. The viruses as a whole are placed in the order of their plant hosts, following Hutchinson's system of classification. A separate section of the book is devoted to a detailed account of the insect vectors of plant viruses. Each chapter is supplemented by a bibliography of the literature cited, and an appendix, likely to be of great service to the practical workers, is provided in the shape of a table showing typical symptoms caused by the different viruses on their more important hosts. It is hoped that the book may both contribute to a clearer understanding of virus problems and help to elevate the study of virus diseases to its rightful position as a distinct science.

Mitchell (H. L.), Finn (R. F.), & Rosendahl (R. O.). **The relation between mycorrhizae and the growth and nutrient absorption of coniferous seedlings in nursery beds.**—*Black Rock For. Pap.* (*N.Y.*), i, 10, pp. 58–73, 2 pl., 2 graphs, 1937.

White pine (*Pinus strobus*) and red spruce (*Picea rubra*) seedlings were grown for two seasons in a very infertile sand-sawdust-clay mixture, and some of the beds were given nitrogen, phosphorus, and potassium in different amounts and combinations, all the fertilized beds being inoculated in the first season with small amounts of soil containing mycorrhizal fungi [*R.A.M.*, xv, p. 596; xvi, p. 827]. Inspection of the seedlings from beds in which nutrient environment was the only variable showed that mycorrhiza were few or absent on the seedlings in all the beds given enough fertilizer to preclude any possibility of mineral nutrient deficiency, that they were more common in the beds of intermediate fertility than in the preceding, and that the best-developed mycorrhiza were formed in abundance on the seedlings grown in every soil deficient in at least one nutrient element. These results indicate that when the appropriate fungi are present and under favourable environmental conditions the frequency of incidence of ectotrophic mycorrhiza and the degree of their development on the roots of pine and spruce seedlings vary inversely as the concentration of readily available nutrients in the soil.

It was also found that the mycorrhizal seedlings of spruce and pine absorbed significantly greater amounts of nitrogen, phosphorus, and potassium and showed a significantly greater increase in dry weight than non-mycorrhizal seedlings grown under otherwise identical conditions in the unfertilized control beds, the latter seedlings showing obvious starvation, making little or no growth, and in the case of spruce, failing to survive the second growing season.

These results are considered to afford incontrovertible proof that

the addition of mycorrhizal fungi to certain soils lacking these organisms can effect the recovery of trees growing in such soils. Chemical analyses of the infected and uninfected soil failed to demonstrate sufficient differences in ammonia and readily available phosphorus and potassium to account for the seedling behaviour solely on the basis of the activity in the soil of mycorrhizal or other fungi in the non-symbiotic role attributed to them by Burges [ibid., xv, p. 673].

HARLEY (J. L.). **Ecological observations on the mycorrhiza of Beech (preliminary note).**—*J. Ecol.*, xxv, 2, pp. 421–423, 1937.

In this preliminary account of a study of beech mycorrhiza in the Chiltern Hills made with special reference to ecological factors the author states that the form of the root system of adult trees was found to vary with soil depth and the extent of the incorporation of plant debris with the mineral fraction. The time of most rapid root growth (chiefly in spring and autumn) is marked by the appearance of numerous uninfected roots. This period is followed by one of infection of the new roots. The shallowest chalk escarpment soils are characterized by a short spring period of growth and infection. In the deepest escarpment soils the spring period of growth persists longer, root growth and infection going on together and being interrupted only by drought; infection is never complete, and many uninfected roots are present in spring and summer. In the very acid plateau soils the roots are near the surface and growth occurs in an upward direction in spring, the incompletely decayed litter of the previous autumn being colonized by uninfected roots; in April and May infection takes place rapidly, while in early summer it is nearly complete.

Eight conditions of infection were observed, viz., (1) uninfected roots, most frequent in the more nutritive and less acid soils, (2) roots infected at the apex only, commonly found in deep escarpment soils, (3) the loose weft type of ectotrophic infection, found only in the most nutritive soils, (4) the diffuse ectotrophic type, most common in the subneutral plateau soils, (5) the pyramidal ectotrophic type, a deeper brown than the preceding, with a racemose habit, confined to the acid plateau soils or places with an accumulation of leaf litter and raw humus, (6) the nodular type consisting of many small racemose systems held together and overgrown by a common sheath, occurring only in acid soils, especially when waterlogged, (7) the endotrophic coralloid type common only in raw-humus soils, and (8) secondary infections by new fungi parasitic on the hyphal sheath and the root tissues within and often recognizable by their characteristic colour (e.g., pink, mauve, bronze, or black); these are commonest in acid soils. The very acid soils contain roots characterized by virulent fungal symbionts, while more nutritive soils contain types of infection in which the growing point of the root is not always inhibited by the fungal sheath. The poorest growth of beech on soils with poor humus incorporation therefore appears to be correlated with the most abundant infection, while the lack of successful growth on the shallow escarpment soils appears to be correlated with the small volume of relatively nutritive soil and its incapacity to retain sufficient water. The moderately acid, deep, nutritive, water-retaining soils bear trees of the greatest vigour. In

these soils the roots are only partially infected and the fungus does not completely control their form.

With rare exceptions all types of infected roots contained more nitrogen per unit weight than uninfected roots. Root systems in poor soils contained more nitrogen than those in better soils. Higher nitrogen content was not correlated with a greater supply of nitrogen to the tree as a whole, there being an inverse correlation between root infection and the nitrogen content of the leaves and buds. It is concluded that while mycorrhizal infection is beneficial to beech trees on poor soil in that it supplies nitrogen, yet, as regards the nitrogen supply to the tree as a whole, it does not completely make up for a low nitrogen content in the soil [see preceding abstract]. The variation in size and vigour noted in the trees studied is attributable to soil variations rather than variations in the mycorrhizal root infections. If such infection does stimulate tree growth this effect must be subsidiary to the effects of soil variations or associated with them in some way not as yet understood.

BALDACCI (E.). **Osservazioni e ricerche sulla vaccinazione delle piante di Fagiolo con il fungo del 'mal della tela'.** [Observations and researches on the vaccination of Bean plants with the 'toile' disease fungus.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 12 pp., 1937. [Latin and English summaries.]

Continuing his studies on acquired immunity [*R.A.M.*, xv, p. 389; xvi, p. 481] the author repeated the experiments of Carbone and his fellow workers on the immunization of bean (*Phaseolus vulgaris*) seedlings against 'toile' disease (*Botrytis cinerea*) under the same experimental conditions as these workers and using a transfer of the 'toile' organism obtained from Carbone. The fungus in question, which Beauverie agreed was the same as that used by him in his researches on immunization (*C.R. Acad. Sci., Paris*, cxxxiii, pp. 107–110, 1901), was identified as a *Rhizoctonia*, a diagnosis confirmed by Peyronel, Castellani, and Ciferri, the last-named stating that it was identical with the 'Vermehrungspilz' (*Moniliopsis aderholdi*) [ibid., xv, p. 586]. Inoculations of the control plants showed that the fungus was only weakly pathogenic, and attempts at 'vaccination' by the method of Carbone and Kalajev [ibid., xi, p. 798] gave negative results, the 'vaccinated' plants showing no increase in resistance over the controls. The fungus was not pathogenic to potato.

GÄUMANN (E.). **Immunitätsprobleme bei Pflanzen.** [Immunity problems in plants.]—*Schweiz. med. Wschr.*, lxvii, 1, pp. 10–15, 4 graphs, 1937.

Some concrete examples are cited to illustrate various aspects of the immunity problem in plants [*R.A.M.*, xvi, p. 50 *et passim*], which is critically discussed in the light of contemporary researches under the headings of infection and disease contraction, protection against infection, passive and active defence against disease, fluctuations in the individual range of disease resistance, the inheritance of disease resistance, and arbitrary intervention in the course of the disease (therapy).

CHOWDHURY (S.). **Germination of fungal spores in relation to atmospheric humidity.**—*Indian J. agric. Sci.*, vii, 4, pp. 653–657, 1937.

Half-inch squares of thin sheet viscose soaked in 1 per cent. glucose solution and dried were used, as recommended by Galloway [*R.A.M.*, xiv, p. 585], as the substratum for the spores of eight Indian fungi, in tests of their germinability in relation to varying percentages of atmospheric humidity from 84·9 to 100. The sheets were suspended in stoppered bottles of 500 c.c. capacity containing 30 c.c. of a sodium chloride or sulphuric acid solution of definite specific gravity at 25° C. Only three species germinated after 20 hours at 90 per cent. relative humidity, viz., *Acrothecium* [*Curvularia*] *penniseti* [ibid., xiii, p. 475], *Alternaria brassicae* (Berk.) Bolle [ibid., xvi, p. 83], and *Cladosporium herbarum*; the minimum requirement of *Helminthosporium frumentacei* Mitra was 91 per cent., of *Gloeosporium tabernaemontanae* and *Phyllosticta cajani* 93·9 per cent., and of *Colletotrichum falcatum* [ibid., xv, p. 463, and below, p. 67] and *C. lindemuthianum* 95 per cent.

MURPHY (P. A.) & LOUGHNANE (J. B.). **A ten years' experiment on the spread of leaf roll in the field.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxi, 48–53, pp. 567–579, 2 figs., 1 graph, 1937.

Details are given of a field experiment carried out in eastern Ireland to ascertain the maximum and minimum spread of potato leaf roll [*R.A.M.*, ix, p. 197] during a ten-year period. It was found that on this basis the years fell into three broad groups, the amount of infection appearing within a 10½ ft. radius of the source not exceeding 75 per cent. in 1926, 1927, and 1929, 50 per cent. in 1930, 1932, 1933, and 1934, and 15 per cent. in 1928, 1931, and 1935. Minimum spread extended to the third plant along the drill and across 1 to 3 drills, and maximum spread exceeded the fourteenth plant and the fifth drill. The evidence showed that in an average year no plant separated from the source of infection by less than 80 in. along and 50 in. across the drills is likely to escape infection, and none separated from the source of infection by more than 21 ft. along and 10½ ft. across the drill is likely to take it. Probably because the prevailing winds are south-westerly the disease spread principally to the north and east.

Most of the infection apparently occurred during a six weeks' period between the end of May and early July. The resulting primary leaf roll appeared during the nine weeks that elapsed from the end of June to the end of August, the incubation period being 37 days at first and 40 to 60 days later. In late seasons most of the infection occurred during July or after. The years of least spread had unusually wet weather in June; this limited aphid increase during the critical period. Maximum infection was induced by normal rainfall and temperature in June, which favoured rapid plant growth while at the same time increasing the aphid population. The years of moderate infection were marked by a dry, hot June, which ripened the plant prematurely. The aphids hibernated each year in an active condition on cabbages in the vicinity. The general absence of leaf roll from eastern Ireland is probably due to the scarceness of the winter hosts of *Myzus persicae* near the potato fields.

PUTTEMANS (A.). **Relação dos fungos e bacterias encontrados na Batateira (Solanum tuberosum L.).** [List of the fungi and bacteria recorded on the Potato (*Solanum tuberosum* L.).]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 265–302, [1937].

The author gives as full a list as possible of all the fungi and bacteria, both parasitic and saprophytic, that have been recorded up to date on the potato throughout the world. The organisms are listed in alphabetical order, with full synonymy and citations of the original descriptions, and where possible, the common Portuguese, Spanish, French, Italian, English, and German names of the diseases caused by the pathogens. In a second list the organisms are grouped in their taxonomic order, following Clements and Shear's system.

COSTA (A. S.) & KRUG (H. P.). **Molestias da Batatinha em São Paulo.** [Potato diseases in São Paulo.]—*Bol. Inst. agron. Campinas* 14, 55 pp., 3 col. pl., 47 figs., 1937.

This is a semi-popular account of the chief diseases of the potato in the State of São Paulo, Brazil. Very frequently in storage and more rarely in the field the tubers are attacked by various rots, three types of which are briefly described, namely, a dry rot caused by various *Fusarium* spp., a stem-end rot caused by different organisms [not specified], and a wet rot, chiefly due to bacteria. The other parasitic diseases discussed include common scab (*Actinomyces*) [*scabies*], *Rhizoctonia* [*Corticium*] *solani*, silver scurf (*Spondylocladium atrovirens*) [*R.A.M.*, xiv, p. 223], early blight (*Alternaria solani*), late blight (*Phytophthora infestans*), wilts caused by *Fusarium oxysporum*, *Verticillium albo-atrum*, *Sclerotium rolfsii*, *Pseudomonas* [*Bacterium*] *solanacearum*, and black leg (*Bacillus phytophthorus*) [*Erwinia phytophthora*]. The virus diseases recorded so far include mild mosaic, super-mild mosaic, crinkle mosaic, rugose mosaic, aucuba mosaic, streak, leaf roll, spindle tuber, and calico. The importation of seed-tubers from the Argentine, the chief source hitherto of the new planting material in Brazil, is strongly deprecated, since recent inspections have shown that this seed usually contains as much as 50 per cent. infection with various virus diseases. Of the certificated European varieties, the Dutch Eigenheimer and Bintje, and the German Rotweissragis and Allerfrühste gelbe are recommended as the most likely to give good results in Brazil. The paper terminates with a discussion of the more important physiological troubles of the potato, and of methods for the control of the parasitic diseases of the crop.

ORTH (H.). **Der Einfluss der Luftfeuchtigkeit auf das Keimverhalten der Sporangien von Phytophthora infestans (Mont.) de Bary, des Erregers der Kartoffelfäule.** [The influence of atmospheric humidity on the germination relations of the sporangia of *Phytophthora infestans* (Mont.) de Bary, the agent of Potato blight.]—*Z. Pfl-Krankh.*, xlvii, 8, pp. 425–447, 7 graphs, 1937.

The results [which are fully discussed and tabulated] of experiments to determine the influence of relative atmospheric humidity (as estimated by the method of von Janisch based on the fact that solutions of salts have definite vapour pressures) on sporangial germination in

Phytophthora infestans [*R.A.M.*, xvi, p. 707] showed that even a slight reduction (about 5 per cent.) below 100 per cent. caused a decline in the capacity of the sporangia for zoospore formation, while exposure to 76 per cent. relative atmospheric humidity completely destroys the sporangia within an hour. Germination was also considerably impaired, especially at the moderate optimum temperatures for the development of the fungus, by one hour's exposure to relative humidities of 94 or 86 per cent. Fluctuations of 5 per cent. or so in the relative atmospheric humidity, even of brief duration, were found to be more detrimental to sporangial development than changes of temperature within a fairly wide range (2° to 34° C.).

Rainio (A. J.). **Perunarton aiheuttamat tuhot Suomessa ja sen esiintymiseen vaikuttavista tekijöistä.** [The damage caused in Finland by Potato blight and the factors influencing its occurrence.]—*Valt. Maatalousk. Julk.*, 95, 47 pp., 3 graphs, 7 maps, 1937. [German summary.]

The annual incidence and virulence of potato blight (*Phytophthora infestans*) [see preceding and next abstracts] in Finland are largely dependent on the weather conditions prevailing in August and September. During the period 1925–36 there were six normal (1927, 1928, 1930, 1931, 1932, and 1936), two severe (1925 and 1934), and four mild years (1926, 1929, 1933, and 1935). The severe blight seasons were characterized by exceptionally damp, close weather, while in the mild ones the critical periods for infection [*R.A.M.*, xvi, p. 514] were fairly dry, with relatively low temperatures and some sharp frosts in the north and east of the country. In the severe year 1934 the reduction in the Finnish potato yield amounted to 4,249,416 quintals, representing a sum of M. 246,000,000 [193·23 M. to the £ at par], the corresponding figures for the normal season 1930 being 2,893,297 quintals (M. 129,000,000), and for the mild one of 1935 1,559,681 quintals (M. 87,000,000).

The heavy losses sustained by the Finnish potato industry through blight are largely due to the widespread cultivation (55 per cent.) of the susceptible indigenous varieties, the yield of which in 1931 was reduced through premature wilting of the foliage by 25 per cent., and through tuber decay by a further 14 per cent., the corresponding figures for selected material being 7 and 3 per cent., respectively. The highest degree of resistance to tuber rot in field tests from 1931–3 was manifested in the early group by Pole Star (average 2·7 per cent. infection), in the medium-early by Rosafolia and Direktor Johanssen (0 and 1·2 per cent., respectively), in the medium-late by Immergut, Parnassia, Erdgold, and Eldorado (0·2, 0·3, 0·4 and 0·5 per cent., respectively), and in the late by Glasgow Favourite (7·7 per cent.). Resistance to leaf infection was most pronounced in the early group in Rosafolia and Lichtblick, in the medium-early in King George V and Paul Wagner, in the medium-late in Jubel, Parnassia, and Max Delbrück, and in the late in Ceres.

It was experimentally shown that infection of the aerial portions of potato plants takes place in Finland a fortnight before any external symptoms become visible on the foliage. The difficulties of growers in

timing the application of sprays have been largely overcome by the provision of adequate observers and by the preparation of special isophane maps indicating the well-defined relationships existing between climatic factors and the development of blight on a given variety at a certain time in different parts of the country. Every year the disease originates in the coastal districts bordering the Gulf of Bothnia, on the isthmus of Karelia, near Viipuri, in the Kymijoki valley, and round the lakes of central Finland, whence it radiates to other localities, reaching Uusimaa last. The northern limits of the fungus are determined exclusively by the degree of frost in a given season; in favourable years it may be found in the northern Arctic coastal regions, having reached Petsamo (69° 32′ northern latitude, 27° 52′ eastern longitude) in 1935. Atmospheric humidity appears to play the major part in the regular development of potato blight, which is almost invariably most prevalent in low-lying situations, near water, and tends to commence in localities where damp lake winds predominate or converge [cf. ibid., xvi, p. 831].

MUNDKUR (B. B.), PAL (B. P.), & NATH (P.). **Relative susceptibility of some wild and cultivated Potato varieties to an epidemic of late-blight at Simla in 1936.**—*Indian J. agric. Sci.*, vii, 4, pp. 627–632, 1 pl., 1937.

Late blight of potatoes (*Phytophthora infestans*) [see preceding abstracts] developed in a virulent form at Simla in 1936, favoured by wet and cloudy weather, especially during July and August [*R.A.M.*, v, pp. 213, 595; x, p. 224]. Of the many European, South American, and Indian potato varieties growing at the local Sub-Station some showed a certain degree of resistance to the disease, from which, moreover, a high proportion of the foreign tuber-forming *Solanum* spp. under observation were semi- or wholly immune. The epidemic thus afforded an opportunity of ascertaining the reaction of these varieties and species to the local physiologic race of *P. infestans* under ideal conditions for the fungus.

President was the most resistant of the commercial varieties under cultivation, while Pusa White, Gharwal, Khabrar, Conoor White, and Darjeeling Red also showed some slight resistance. Only about six of the 124 South American varieties of *S. tuberosum* included in the trials showed a promising degree of resistance. Most of the varieties comprised within the species *S. andigenum* [ibid., xvi, p. 554] were highly resistant as regards stems and tubers, but the foliage contracted moderate infection in the later stages of growth. Absolute immunity was manifested by *S. demissum*, *S. neoantipoviczii* and its var. *reddickii*, and *S. antipoviczii*. Fair resistance was shown by the stems and tubers of *S. chacolense*, *S. caldsii glabrescens*, and *S. commersonii*, but the foliage of these varieties was very susceptible, as also were all parts of *S. fendleri*, *S. maglia*, *S. otites*, and *S. leptostigma*.

MULLER (H. R. A.). **De Aardappelsituatie op Java als gevolg van het optreden van eenige nieuwe ziekten.** [The Potato situation in Java in consequence of the occurrence of some new diseases.]—*Landbouw*, xiii, 6, pp. 285–313, 2 figs., 1937. [English summary.]

Hitherto the most important potato disease in Java was caused by *Bacterium solanacearum* [*R.A.M.*, xiii, p. 687], but in 1936 a devastating

outbreak of late blight (*Phytophthora infestans*) rapidly decimated the crop, while many consignments of seed potatoes from Holland had to be destroyed by the plant quarantine authorities on account of infection by *Colletotrichum atramentarium* [ibid., xvi, p. 655], not previously known in the Dutch East Indies.

The physiologic race of *P. infestans* occurring in Java would appear, from the outcome of inoculation tests on a number of Dutch varieties, to be identical with that found in Holland [ibid., xv, p. 246]. In these experiments West Brabanter and Iris were susceptible, Record, Bevelander, Industrie, and Nationaal fairly resistant, and Populair and Robijn highly so. Observations in various districts further indicated that Van der Veen, Eersteling [Duke of York], Bintje, Kentang Djawa, Preanger Muis, and Koninjkes belong to the highly susceptible category, while Paul Krüger [President] and Eigenheimer are less severely affected and can probably be maintained in fair condition by spraying with Bordeaux mixture. These data apply exclusively to foliage infection, tuber rot being apparently of no importance in Java where sandy soils, unfavourable to this phase of the disease [ibid., iv, p. 763], predominate in the potato-growing districts. One fungicidal treatment or two at the most should suffice for Bevelander and varieties of a like degree of resistance, in the case of Eigenheimer planted after the west monsoon an increased yield of 28 quintals per hect. may be reckoned to result from two applications of Bordeaux mixture at a cost of roughly Fl. 40. In connexion with the extended cultivation of *Phytophthora*-resistant varieties, it is pointed out that a number of these, e.g., Bevelander, Eigenheimer, Robijn, and Populair are highly susceptible to *Bact. solanacearum*, and can therefore be grown only in districts where slime disease is relatively unimportant. Progress has been made, however, in the development of resistance to *Bact. solanacearum* by the hybridization of certain commercial varieties with the South American *Solanum andigenum* and *S. antipoviczii*, which are likewise resistant to *P. infestans* [see preceding abstract]. The importation of seed potatoes from Holland being temporarily impracticable owing to infestation by *C. atramentarium*, attempts are in progress to combat this fungus by various methods.

A useful tabular synopsis is appended showing the symptoms of *Alternaria solani* [ibid., v, p. 652; xvi, p. 402], *P. infestans*, *Cercospora concors* [ibid., xv, p. 246] (which sometimes causes a certain amount of damage in the Dutch E. Indies), *Bact. solanacearum*, and *Colletotrichum atramentarium* on potato foliage, and those of *A. solani* (not yet recorded on tubers from the Dutch East Indies), *P. infestans*, *C. atramentarium*, and *Bact. solanacearum* on the tubers.

[This paper also appears as *Korte Meded. Inst. PlZiekt.* 23, 29 pp., 2 figs., 1937.]

PUTTEMANS (A.). **Reivindicação visando a denominação scientifica da doença da Batateira (Phytophthora infestans) (Mont.) de By.** [A plea for the revision of the scientific name of Potato blight (*Phytophthora infestans*) (Mont.) de By.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 341–350, [1937].

The author states that the causal organism of potato late blight was

named *Botrytis devastatrix* by Mlle Libert in the *Journal de Liège*, on the 19th August, 1845, i.e., eleven days before Montagne presented his paper to the Société Phylomatique of Paris, in which he described the same fungus under the name *B. infestans*. On grounds of priority, therefore, the author renames the fungus *P. devastatrix* (Lib.) n.comb.

Fish (S.), Pugsley (A. T.), & Ryland (J .P.). **'Leak' or 'watery wound rot' of Potatoes.**—*J. Dep. Agric. Vict.*, xxxv, 6, pp. 287–289, 2 figs., 1937.

Potato growers in the vicinity of Dalmore and Koo-wee-rup, Victoria, have for some years suffered severe losses in marketing as a result of tuber infection by *Pythium de Baryanum* following mechanical injury [*R.A.M.*, x, p. 544]. The disease is most prevalent in hot weather and in potatoes from farms where rotation is not practised, little trouble being experienced by farmers adopting a long rotation. The fungus may produce complete decay of the tuber in a day or two. Control recommendations include long rotation, destruction of diseased tubers, avoidance of mechanical injury, bagging sound potatoes only, keeping the temperature of the tubers as low as possible by digging only in the cool hours, or digging 'short' runs before bagging, and not using loading hooks for potatoes from affected localities.

Baldacci (E.). **Ricerche ed esperienze sulle malattie del Riso (Oryza sativa L.). II. Il 'brusone' non parassitario del Riso.** [Researches and experiments on diseases of Rice (*Oryza sativa* L.). II. Non-parasitic blast of Rice.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, x, 30 pp., 21 figs., 1937. [Latin and English summaries.]

In 1934, rice growing on freshly reclaimed peat soil in a permanently or semi-permanently flooded region in the vicinity of Ferrara was affected by a non-parasitic form of blast causing a loss of yield ranging from 20 to 100 per cent. All the affected plants showed abnormalities in the roots before the aerial parts developed any symptoms. The extremities of the fine rootlets were discoloured and wilted and later sometimes showed the presence of saprophytes. In two instances only did the affected plants show the presence of *Piricularia oryzae*. Drainage water from the soils in question proved toxic to rice seedlings, impeding germination, and causing injuries to the fine rootlets, identical with those observed in nature. It is concluded that the disease is probably due to a number of soil factors which have not yet been definitely ascertained, and principally to insufficient aeration aggravated by anaerobiotic or microanaerobiotic conditions in the soil.

Naito (N.). **On the effect of sunlight upon the development of the Helminthosporium disease of Rice.**—*Ann. phytopath. Soc. Japan*, vii, 1, pp. 1–13, 1 graph., 1937. [Japanese, with English summary.]

Rice seedlings were experimentally shown to be more extensively infected by *Ophiobolus miyabeanus* [*R.A.M.*, xvi, p. 771] in the absence than in the presence of light. Absence of light further increased both the incidence of conidial germination and the length of the germ-tubes. Using four glass boxes kept under identical conditions except for variations in light intensity, the writer determined the effect on the course

of the disease of shading the seedlings after inoculation. The maximum number of fungal lesions per unit length of leaf occurred on the seedlings grown in the box covered with two sheets of cotton cloth, and the minimum on those in the box covered with black paper; the seedlings in the uncovered boxes and in those protected by a single sheet of cotton cloth developed an intermediate number of lesions. In a similar test to ascertain the effect of shading before inoculation, the maximum number of lesions occurred on the seedlings kept in the box covered with a single sheet and the minimum on those in the box covered with two sheets of cotton cloth, the figures for the black paper-covered and unprotected boxes being intermediate.

Beeley (F.) & Napper (R. P. N.). **Annual Report. Pathological Division.**—*Rep. Rubb. Res. Inst. Malaya, 1936*, pp. 77–98, 1937.

As a result of tests conducted since 1933, an improved method of trenching for the control of root disease of *Hevea* rubber (*Fomes lignosus*, *F. noxius*, and *Ganoderma pseudoferreum*) [*R.A.M.*, xvi, pp. 60, 798] in mature areas has been devised in Malaya. To ensure that a trench shall pass outside a diseased patch it is only necessary to examine the root sections removed as the trench progresses, and move the trench farther out if any infected material is found. The trenches should be refilled with the original soil to a depth of not less than 18 in. as soon as dug, efficiency being restored by re-digging every 18 months or two years. In six months the trenches become full of small roots, through which, however, infection passes only very slowly.

In stands 25 to 35 years of age disease patches usually occupy 25 per cent. of the planted area, but only 30 per cent. of the infected ground requires deep digging. The cost of deep marginal, and shallow central, digging of diseased patches for eradication works out locally at $80 and $30 per acre, respectively, equivalent to about $11 per acre for the whole plantation; the digging of isolation trenches costs $3 to 5 per acre in the first year, and $1 to 2 per acre for upkeep every second year, and, in addition, the full cost of digging has still to be incurred when the isolated areas are replanted or supplied. Immediate eradication is, therefore, ultimately the cheaper method. In replanting the digging of diseased patches should be completed before felling is begun, while the diseased patches are clearly marked by gaps. Whatever the method of clearing, root-disease losses must be expected in the young stand for the first few years, but if digging is adequately effected they are few and easily dealt with by means of the standard treatment, and complete, permanent eradication may confidently be expected by the time the replanted stand reaches maturity. This, however, does not apply to coastal and peat soils, in which heavy losses are experienced in undug areas apparently unaffected at felling, dormant sources of infection being roused into activity by the lowering of the water-table. In these areas, digging over the whole plantation may in the long run prove more economical than the standard treatment.

Mouldy rot (*Ceratostomella fimbriata*) [ibid., xvi, p. 772] was checked by hot, dry weather from June to August, inclusive, during which period the perithecia were seen on several occasions.

Black stripe (*Phytophthora* spp.) [*P. palmivora*, *P. meadii*, and *P.*

heveae: ibid., xiii, p. 125; cf. ibid., xvi, p. 798] caused more bark damage than before in a locality where clean weeding had been abandoned in favour of a heavy cover crop of *Centrosema pubescens*, which increased atmospheric humidity round the tapping panels.

The new leaf remained practically free from attack by *Oidium heveae* [ibid., xvi, p. 772] up to 10th March, after which date the later wintering trees showed mild infection. 'Cirrus' sulphur dust was found to be satisfactory even after long storage under Malayan conditions. A few cases of leaf disease (*Phytophthora* sp.) occurred in northern areas, and a sulphur-copper oxychloride dust is being prepared which, it is hoped, will control both types of mildew.

Much trouble was caused in nurseries and to young rubber in the field by the leaf spot fungi *Helminthosporium heveae* [ibid., xii, p. 425], *Gloeosporium heveae* [ibid., iii, p. 478], *Colletotrichum* sp., and *Scolecotrichum* sp.

Of eight proprietary fungicides tested against mouldy rot only 'durycolium' and 'white septol' were satisfactory and are to be added to the 'white list'.

DENNIS (R. W. G.). **Boron and plant life: recent developments in agriculture and horticulture.**—*Fertil. Feed St. J.*, xxii, 18, pp. 479–480, 482–483; 19, pp. 507, 509–511; 20, pp. 535–536, 538; 21, pp. 573–576, 4 figs., 1937.

This is a summary of recent outstanding researches on the influence of boron on plant growth and health [*R.A.M.*, xvi, p. 827], supplemented by a bibliography of 71 titles, reference to most of which has been made from time to time in this *Review*.

DENNIS (R. W. G.) & O'BRIEN (D. G.). **Boron in agriculture.**—*Res. Bull. W. Scot. agric. Coll.* 5, 98 pp., 12 pl., 2 maps, 1937.

This bulletin, the purpose of which is to indicate the present state of knowledge of the agricultural status of boron [see preceding abstract], consists of a collection of papers on the effects of boron and boron deficiency on agricultural crops arranged under the different plants, preceded by a paper of a general nature on boron in the soil and concluding with papers on the boron requirements of various crops, the function of boron in the plant, and the method of applying boron to crops. Each paper is a summary of the more important work published on the subject dealt with, and is followed by a bibliography.

COOKSON (ISABEL). **On Saprolegnia terrestris sp. nov., with some preliminary observations on Victorian soil Saprolegniales.**—*Proc. roy. Soc. Vict.*, N.S., xlix, 2, pp. 235–244, 1 pl., 2 figs., 1937.

Notes are given on 11 members of the Saprolegniales isolated from three distinct types of soil in Victoria, together with a full description (accompanied by a diagnosis in English) of a hitherto unrecorded species found in soil taken from the fern gullies of the Dandenong Ranges, near Melbourne, which is named *Saprolegnia terrestris* n.sp.

NIETHAMMER (ANNELIESE). **Die mikroskopischen Boden-Pilze.** [The microscopic soil fungi.]—vi + 193 pp., 5 pl., 57 figs., 1 map, The Hague, W. Junk, 1937. Price Fl. 17.

After a brief introduction, the author devotes 100 pages to a systematic account of the fungi recorded from soil [*R.A.M.*, xvi, p. 557], with notes on distribution and characters of each species. The distribution of soil fungi by countries is discussed in considerable detail (42 pp.), and the remaining pages deal with the relations of soil fungi to pathology, to growth, to manurial questions, their activities in the soil, and their dissemination. A bibliography of 146 titles [but nevertheless somewhat incomplete] is appended.

LINKE (W.). **Hop Peronospora.**—*Petit J. Brass.*, xlv, pp. 539–531 [? 541], 1937. [French. Abs. in *J. Inst. Brew.*, N.S., xxxiv, 8, p. 344, 1937.]

In these notes on the development and control of *Peronospora* [*Pseudoperonospora humuli*] on hops [*R.A.M.*, xv, p. 74; xvi, p. 61] in Belgium it is stated that Hallertau Mittelfrüh and American Cluster hops are very susceptible to the fungus at all stages of growth, Groene Bel and Buvrinnes are particularly vulnerable in flower and burr, Tettnang and Fuggles moderately resistant, and Loeres semi-immune.

WATSON (MARION A.). **Field experiments on the control of Aphis-transmitted virus diseases of Hyoscyamus niger.**—*Ann. appl. Biol.*, xxiv, 3, pp. 557–573, 2 diags., 1937.

Details are given of spraying experiments in 1934 and 1935 on *Hyoscyamus niger*, grown as a biennial pharmaceutical crop, the results of which showed that infestation of the plants in the first year of growth with the aphid *Myzus persicae*, vector of the Hy. II and Hy. III viruses [*R.A.M.*, xii, p. 243], was reduced by applications of a solution of nicotine and soft soap for the first two months of vegetation. The greatest reduction was obtained by spraying at weekly intervals, but a slight reduction was also effected by weekly or fortnightly applications either in June or July. The percentage of infection with the viruses was lower in the sprayed than in the unsprayed plots. While none of the treatments appeared to affect the yield of the plants at the first cropping in the first year of growth, which coincided with the end of the spraying period, the plots that received weekly applications in the first year gave a 30 per cent. increase of yield in the third crop obtained in May of the second year of growth.

SCHINDLER (H.). **Untersuchungen über eine an Cereus grandiflorus Mill. beobachtete Gewebenekrose.** [Investigations on a tissue necrosis observed in *Cereus grandiflorus* Mill.]—*Angew. Bot.*, xix, 4, pp. 505–508, 2 figs., 1937.

Cereus grandiflorus, a valuable medicinal plant extensively cultivated at a Dresden biological institute, was affected in 1936 by tissue necrosis, externally manifested by brown spots, several cm. in length and about 3 mm. in width, on the young shoots. Microscopic examination disclosed a brown discoloration of the epidermis and hypoderm and well-

marked necrosis of the underlying cells of the assimilation parenchyma, the walls of which were brown, the chloroplasts disintegrated, and the cytoplasm completely disorganized. The affected tissue was separated from the healthy by a periderm, and the development of the plants was not impeded. The cause of the necrosis is obscure, but may possibly be connected with disturbances in transpiration due to abrupt temperature and humidity fluctuations.

Arruda (S. C.) & Gonçalves (R. D.). **A 'murcha', uma nova doença da Mamona em S. Paulo.** ['Wilt', a new disease of the Castor Bean in S. Paulo.]—*Biologico*, iii, 8, pp. 232–235, 2 pl., 1937.

An account is given of a disease of castor bean [*Ricinus communis*] which, although it has only been observed so far in two localities of São Paulo, Brazil, may eventually prove to be a major trouble of the crop. The chief symptom is a wilting of the foliage, usually beginning from the lower leaves and gradually spreading to the apical ones, very frequently affecting only one side of the plant. The condition is accompanied by the development on the stem, most commonly from the top downwards, of dark grey to black necrotic bands, bearing pink or salmon-pink sporodochia, about 1 mm. in diameter, of a species of *Fusarium* [cf. *R.A.M.*, xvi, p. 560], the mycelium of which was always found in the discoloured vascular bundles of the diseased stalks and roots. The root system of infected plants is rotted, and infection is believed to occur through this channel. Castor plants apparently dead may occasionally put forth a few new shoots from soil level, but these are invariably diseased and die more or less rapidly. The constant association of the fungus with the disease suggests that it is the causal organism, and inoculation experiments are now in hand to test this hypothesis. The control measures tentatively suggested include the careful and early roguing out and incineration of all diseased plants, and the eventual development of resistant varieties.

Mention is also made of two other diseases of the castor bean in São Paulo which are now being investigated, and one of which is apparently caused by a species of *Ceratostomella*, and the second by a species of *Phytophthora* closely resembling *P. parasitica* [ibid., xv, p. 378].

Ferguson Wood (E. J.). **Some anatomical and cytological studies on Fiji disease of Sugar-Cane.**—*Proc. roy. Soc. Vict.*, N.S., xlix, 2, pp. 308–313, 4 figs., 1937.

An anatomical and cytological study of Fiji disease of sugar-cane [*R.A.M.*, iii, p. 606; xvi, p. 205, and next abstract] showed the presence of five regions in the stem galls, (1) protoxylem vessels and lacuna, (2) primary metaxylem vessels, sometimes hypertrophied, (3) the lignified, pitted cells forming a tracheidal tissue surrounding the bundle and for which the name 'pseudotracheid' is suggested, (4) a hypertrophied phloem, and (5) the pseudoparenchymatous tissue lying chiefly between the phloem and the sclerotic tissue, and consisting of equidiametrical cells with large, rapidly dividing nuclei which give rise to the pseudotracheids and sieve-tubes. Galls are characteristically present in the micro-bundles of the leaves, where they produce hypertrophy of the

phloem, a pseudoparenchyma consisting of a few cells, and asymmetry of the xylem.

Contrary to Kunkel's view that the condition is a phloem disease, the author regards it as essentially meristematic, and adduces a number of facts in support of this view. For instance, in the diseased tissue the sieve-tubes and companion cells are more numerous than in healthy tissue, suggesting cambial activity. The pseudotracheids are produced by a metamorphosis of the pseudoparenchyma, which is clearly meristematic, while the sclerotic tissue is homologous with a secondary metaxylem. Rays of sieve-tubes often cut through the sclerotic sheath, and in the galls the phloem may lie outside this, the galls showing no constant arrangement of the tissues.

Observation of living and stained sections showed that the mononucleate pseudoparenchyma cell often becomes multinucleate, inclusion bodies appear, the nucleus disappears as the cell wall thickens, and finally the bodies and cell contents disappear, and a pseudotracheid develops. The bodies appeared to consist of degenerating nuclear material.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**— *Rep. Bur. Sug. Exp. Stas Qd, 1936–37*, pp. 34–41, 1937.

Recent surveys indicate that sugar-cane leaf scald [*Bacterium albilineans*: *R.A.M.*, xv, p. 320; xvi, p. 562] is not present in Queensland south of Townsville; in the dry Cairns-Mossman belt the susceptible varieties Clark's Seedling (H.Q. 426) and S.J. 4 are extensively grown, since natural spread is very slow and adverse seasonal conditions kill off large numbers of diseased stools, thus removing sources of mechanical infection. Downy mildew [*Sclerospora sacchari*: ibid., xv, p. 320] became increasingly prevalent in the Mackay area, and strong measures had to be adopted to check an outbreak on the Meringa Station. Gumming disease [*Bact. vasculorum*: ibid., xvi, p. 277] is now practically non-existent in the southern parts of Queensland. In the Mulgrave area, however, prolonged rains in 1936 favoured spread, and by the end of November the disease had been recognized in 24 farms, and was suspected to be present on at least four more. Spread took place in a north-westerly direction, in the path of the prevailing wind, and was assisted by an illicit transfer of canes from the south to the north side of the Mulgrave River. The boundaries of the quarantine area have been enlarged accordingly. Trials at Bundaberg indicated that P.O.J. 2725, like P.O.J. 2878, confers high resistance to gumming on a very high proportion of its progeny. It was ascertained that the disease is transmissible both naturally and artificially to several varieties of dent and sweet maize.

Fiji disease [loc. cit., and preceding abstract] occurred on several farms in the Isis mill area, and also in the Moreton area, where stricter measures are required as it is not being held in check.

Rind disease (*Pleocyta sacchari*) [ibid., xvi, p. 774] became very important in the Bundaberg–Isis area, where it was almost wholly confined to standover P.O.J. 2878; it was also found on H.Q. 458 at Mourilyan and Hambledon. Incidence appears to bear a close relationship to overmaturity.

Field surveys confirmed the greater incidence of chlorotic streak [fourth disease: ibid., xvi, p. 561] in low, badly drained areas than elsewhere, and showed that secondary spread may be very rapid. In the first varietal resistance trial conducted locally (with 17 varieties) the disease did not appear in the plant crop, but developed in the ratoons, the varieties least affected being Q. 4, Co. 290, P.O.J. 234, B. 147, D. 1135, and Uba with 0, 0, 0, 1, 1, and 1 diseased stools, out of 17, 22, 27, 16, 18, and 20, respectively, and those most susceptible Q. 12, Badila, H.Q. 426, and S.J. 4, with 11, 13, 14, and 16 diseased stools out of 20, 24, 19, and 19, respectively, while the others were intermediate.

ORIAN (G.). **Un nouvel hôte naturel du Bacterium vasculorum (Cobb) Gr. Smith, à Maurice.** [A new natural host of *Bacterium vasculorum* (Cobb) Gr. Smith, in Mauritius.]—*Rev. agric. Maurice, 1937*, 94, pp. 130–131, 1937.

In April, 1935, the young leaves of tiger grass (*Thysanolaena maxima* Kuntze) [*T. agrostis* Nees] growing in Mauritius developed broad, whitish, longitudinal stripes progressing from the base upwards, and dried up from the tip downwards. A yellowish gum was exuded from the vessels of the stalk and sheaths, and isolations yielded a bacterium resembling *Bacterium vasculorum* [cf. *R.A.M.*, xvi, p. 744] which, though not yet definitely identified, produced symptoms typical of *Bact. vasculorum* on inoculation into sugar-cane.

Investigations on Sugar-Cane diseases in Louisiana in 1936–1937.—*Bull. La agric. Exp. Sta.* 288, 12 pp., 1937.

C. W. Edgerton, I. L. Forbes, and P. J. Mills state that in comparative tests, carried out in Louisiana, Co. 290 sugar-cane grown from seed 100 per cent. infected with mosaic [*R.A.M.*, xvi, p. 276] showed reductions in yield, as compared with cane from healthy seed, of 0·8, 16·5, and 6·9 per cent., in 1934, 1935, and 1936, respectively, the corresponding figures for Co. 281 in the four years 1933–6 being 0·8, 9·2, 6·1, and 8·9 per cent.; there is therefore no indication that losses from mosaic are increasing from year to year in these very valuable varieties. C.P. 28–19 showed 13·2 per cent. reduction in yield in 1935, followed by 1·3 per cent. increased yield over the healthy cane in 1936. C.P. 28–70 planted from yellow mosaic cane showed in 1933, 1934, and 1935 a decrease in yield of 31·8, 61·4, and 49·5 per cent., respectively, while infected C.P. 29–320 gave an increased yield of 3·8 per cent. over the healthy in 1935; other varieties were intermediate. The varieties tested thus fall into three groups, (1) those that readily take infection, and do not throw it off, viz., Co. 281, Co. 290, and C.P. 29–291; (2) those that do not take infection readily, but do not throw it off, viz., C.P. 28–11; and (3) those that do not take infection readily, but readily throw it off, viz., C.P. 28–19 and C.P. 29–320.

When healthy seed cane and cane inoculated with red rot (*Colletotrichum falcatum*) [ibid., xvi, p. 206] were grown in comparative tests only P.O.J. 213 and C.P. 807 showed very marked reduction in yield owing to infection, the inoculated cane of the former variety in 1935 yielding 9·2 tons per acre as against 31·7 tons for the uninoculated,

the corresponding figures for the latter variety being 22 and 47·4 tons. C.P. 28–11 showed no reduction.

R. E. Atkinson and C. W. Edgerton state that when sugar-cane stalks were cut and inoculated with a pure culture of *C. falcatum* and then planted, red areas appeared after four days 48 in. away from the point of inoculation. In a further experiment the fungus was reisolated from similar areas which appeared 3 or 4 internodes above the inoculated internode in five days. Living stalks of C.P. 807 cane with the top leaves attached were then placed in a spore suspension of the fungus, and the lowest node cut off under the surface of the water. Two days later, 2 out of 30 pieces from the third and fourth internodes above yielded the fungus. Spores of the fungus were also readily drawn through cane stalks by means of a vacuum pump. These results show that the spores of *C. falcatum* are able to travel through the fibrovascular bundles of sugar-cane and such passage probably occurs when cut stalks become infected at planting.

In immunity studies carried out by I. L. Forbes, P. J. Mills, and C. W. Edgerton 128 stalks of C.P. 28–70 cane showing yellow mosaic were inoculated with green mosaic and 150 stalks of the same variety showing green mosaic were inoculated with yellow mosaic, all the canes being later planted in the field. Every stool resulting from the yellow mosaic stalks inoculated with green mosaic showed yellow mosaic symptoms (with a few plants showing doubtful green mosaic symptoms in the new growth) and vice versa. This result shows that the viruses are distinct, that they do not occur together in the same plant, and that a plant affected by one is immune from the other.

Caminha (A.). **Doenças da Canna de Assucar no Brasil.** [Diseases of the Sugar-Cane in Brazil.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 191–196, [1937].

The information contained in this paper concerning the sugar-cane diseases in Brazil has already been noticed from another source [*R.A.M.*, xvi, pp. 126, 127].

Grove (W. B.). **British stem- and leaf-fungi (Coelomycetes). Vol. II.** —ix+407 pp., 99 figs., Cambridge University Press, 1937. Price £1 1*s*.

This volume completes the work [*R.A.M.*, xv, p. 53], and comprises the sections Sphaerioideae with coloured spores, Nectrioideae, Excipulaceae, Leptostromataceae, and the Melanconiales. The systematic account of 357 pages follows the method of Volume I, with a small addendum to which the present work closes, together with the Latin diagnoses of three new genera and some twenty new species, an epilogue, an index to those Ascomycetes recorded as representing the perfect state of various Coelomycetes, a host index, and an index of binomial names.

Among the fungi well known to plant pathologists, the author's treatment of the following may be mentioned. He maintains both the genera *Vermicularia* Fr. and *Colletotrichum* Corda [cf. ibid., viii, p. 268]; in the former the setae are an essential element, often produced [illegible] before the spores are formed; in the latter the

setae are inessential, as it were an afterthought, and may be many, few, or none; *C. gloeosporioides* is accordingly listed, as it was originally described, as *V. gloeosporioides*. The genus *Gloeosporium* is maintained more or less as it appears in Sylloge III, and few of its numerous segregates are recognized. *Sphaceloma rosarum* (Passer.) Jenkins [ibid., xii, p. 96] becomes *G. rosarum* (Passer.) Grove.

The polymorphic fungus mat often recognized as *Hainesia lythri* [ibid., xiv, p. 180] is listed under one of its pycnidial names as *Leptothyrium macrothecium*, and the long list of synonyms established by Shear and Dodge [ibid., i, p. 110] is considered to represent 'a thoroughly optimistic view'.

The author's treatment of *Sphaeropsis malorum* Berk. may prove a difficulty. On p. 17 the species is listed as a valid species with 'spores oblong, continuous, brown, 22 to 32 by 10 to 14 μ'. [This description answers rather to *S. malorum* Peck = *Haplosporella mali* = *Physalospora obtusa*.] On p. 53, *S. malorum* Berk. is cited as a synonym of *Diplodia malorum* Fckl. The author does not accept *D. mutila* [= *P. mutila*: ibid., xvi, p. 543] for *D. malorum*, for he considers it is unlikely that a fungus that is found on apples on the ground should also occur on *Populus* 'because such a change of habitat is contrary to our experience in this country'.

The spelling *Pestalotia* [ibid., viii, p. 605] is adopted, but 'anyone who prefers the double z . . . is at liberty to write *Pestalozzia* and nobody will be one penny the worse'. The author refuses to reverse the practice of 50 years in order to make a generic name *Hendersonia* conform to its original type species, since the inconvenience can be avoided by making *Hendersonia* Berk. emend. a *nomen conservandum*.

The work is the outcome of years of careful study of this difficult group of fungi and constitutes a most valuable contribution to British mycology.

Tehon (L. R.). **Notes on the parasitic fungi of Illinois—VI.**—*Mycologia*, xxix, 4, pp. 434–446, 9 figs., 1937.

In this further instalment of this series [*R.A.M.*, xii, p. 788] the author discusses 14 species of apparently plant-parasitic fungi from Illinois, including one new genus and twelve new species, Latin diagnoses of which are appended. The following may be mentioned. *Mycosphaerella holci* n. sp. occurs on living leaves of broom corn (*Holcus sorghum* var. *technicus*), with innate perithecia, 60 to 100 μ in diameter, cylindrical to clavate asci, 30 to 45 by 8 to 12 μ, and biseriate, hyaline, bicellular ascospores, 12 to 15 by 5 to 6 μ, constricted at the septum, and with the upper cell somewhat larger than the lower. The constant occurrence among the perithecia of pycnidia of a *Phyllosticta*, with somewhat curved, oblong spores, rounded at both ends, and 6 to 7 by 3 to 3·5 μ, apparently referable to *P. sorghina* Sacc., suggests that the latter may be the imperfect spore form. The ascogenous form has several points in common with *Sphaerella ceres* Sacc. reported on sorghum from Italy, the pycnidial stage of which is reported to be *Ascochyta sorghi* Sacc., and may eventually prove to be synonymous with it. *Glomerella vignicaulis* n. sp. was found on dead *Vigna sinensis* [*V. unguiculata*] stems intimately associated with a species of *Cercospora*

described as a new species under the name *C. vignicaulis*. *Macrophoma rubi* n. sp. causes stem lesions on the cultivated Latham raspberry; the pycnidia are black (brown by transmitted light), spherical to markedly applanate, and 135 to 330 μ in diameter; spores are hyaline, continuous, irregularly oblong, obtuse distally and tapered basally, straight or somewhat curved, and 15 to 25 by 4·2 to 6·6 μ (chiefly 18 to 20 by 4·5 to 5 μ). The fungus enters the host at the juncture of leaf and stem, and is obviously parasitic. *Coniothyrium radicicola* n. sp. was isolated from the cortical tissues of dying *Ulmus americana* roots, and *Ascochyta negundinis* n. sp. from leaf spots on *Acer negundo*. *Coniothyrium caryogenum* [ibid., ii, p. 283] was found on *Carya alba*, a new host for this species, and a new record of the fungus for Illinois. A new genus, *Chaetoseptoria* (differing from *Septoria* by its setose pycnidia), is created for *C. vignae*, which forms on the leaves of *V. unguiculata* scattered, membranous pycnidia, 100 to 165 μ in diameter, with an ostiole surrounded by a ring of erect, straight, brown, septate, acute setae, 50 to 165 by 5 to 9 μ; the spores are hyaline, acicular, straight to arcuate uni- to pluri- (usually 3- or 4-) septate, and 18 to 50 by 1·5 to 2·2 μ in diameter.

Jenkins (Anna E.) & Bitancourt (A. A.). **Doenças das plantas causadas por fungos dos generos Elsinoe e Sphaceloma.** [Plant diseases caused by fungi belonging to the genera *Elsinoe* and *Sphaceloma*.] —*Rodriguésia*, ii, Num. esp., (*1936*), pp. 305–313, 1 fig., [1937]. [English summary.]

A brief account is given of the general morphological characteristics of the genus *Elsinoe* and its pleomorphic conidial stage *Sphaceloma* [*R.A.M.*, xi, p. 723 *et passim*], as well as an historical outline of its taxonomy. A brief discussion then follows of the distribution throughout the world of the species of this group—approximately 30—known up to date, which are listed together in a table indicating their hosts, geographical distribution by continents, and the country and date of their earliest known record. The 13 species occurring in South America are grouped together in a second table, which also indicates all the available records of them in literature.

Grillo (H. V. S.). **Lista preliminar dos fungos assignalados en plantas do Brasil.** [Preliminary list of fungi recorded on plants in Brazil.]—*Rodriguésia*, ii, Num. esp., (*1936*), pp. 39–96, [1937].

Pending the publication, which is expected shortly, of a complete systematic catalogue of Brazilian fungi, the author gives in this paper a preliminary list of all the phytopathogenic fungi that have been recorded in Brazil up to date on plants of economic or ornamental value. The fungi are listed under their respective hosts.

Herbert (D. A.). **Records of Queensland fungi. II.**—*Qd Nat.*, x, 3, pp. 59–60, 1937.

An annotated list is given of six rusts and eight smuts occurring in Queensland, including *Puccinia calendulae* on English marigold (*Calendula officinalis*), which has assumed a virulent form during the last

three years, *P. cinerariae* on cineraria [*Senecio cruentus*] leaves, *P. distincta* on daisy (*Bellis perennis*), and *Uromycladium alpinum* on *Acacia decora*.

Salgues (R.). **Deuxième contribution à la flore microcryptogamique de l'Ile de Port-Cros.** [Second contribution to the microcryptogamic flora of the Isle of Port-Cros.]—*Ann. Soc. Hist. nat. Toulon*, xx (*1936*), pp. 130–133, [?] 1937.

Among the species enumerated in this list of 71 fungi detected by the writer in connexion with his chemico-phytopathological studies on the Isle of Port-Cros [off the south of France] may be mentioned *Ascochyta oleandri* on *Nerium oleander*, *A. pseudacori* on *Iris germanica*, *A. robiniae* on *Robinia pseud-acacia*, *A. rosmarini* on *Rosmarinus officinalis*, *Cercospora molleriana* on *Arbutus unedo*, *C. myrti* on *Myrtus communis*, *Erysiphe* [*Oidiopsis*] *taurica* [see above, p. 15] on fennel (*Foeniculum vulgare*), *Guignardia cylindrica* on *Platanus orientalis*, *Hendersonia agaves* and *Tubercularia concentrica* on *Agave americana*, *Leptosphaeria helicicola* on ivy (*Hedera helix*), *Metasphaeria vincae* on *Vinca major*, *Microdiplodia iridicola* on *I. germanica*, *Mycosphaerella pistaciae* on *Pistacia lentiscus*, *Ovularia vitis* on vine, *Phyllosticta althaeicola* on *Althaea officinalis*, *P. ficicola* on fig [ibid., xi, p. 268], *P. morifolia* on mulberry (*Morus alba*), *P. oleae* on olive, *Ramularia cynarae* on artichoke (*Cynara scolymus*) [ibid., xi, p. 745], *Sclerotium yuccae* on *Yucca* sp., *Septoria anthophila* on *Hydrangea hortensis*, *S. arbuti* on *Arbutus unedo*, *S. lavandulae* on *Lavandula stoechas* [ibid., xv, p. 257], and *S. scillae* on *Muscari comosum*.

Chaudhuri (H.)., Kapur (V. S.), Bhatia (K. L.), & Anand (J. S.). **Diseases of the Tea bush in the Kangra Valley, Punjab, I.**—*Indian J. agric. Sci.*, vii, 4, pp. 565–573, 2 pl. (1 col.), 1937.

Following a brief introductory note on the history, development, and present position of tea cultivation in the Kangra Valley of the Punjab (where drastic measures are necessary to combat the general decline of the industry), the writers describe their investigations from 1930–4 on eight of the many diseases observed and the agents responsible for them. Grey blight (*Pestalozzia theae*) [*R.A.M.*, xvi, p. 798] is widespread and causes considerable loss. Brown spot (*Phoma theicola*) [ibid., iii, p. 4], less common than the foregoing, is characterized by reddish-brown patches on both leaf surfaces. Brown blight (*Colletotrichum camelliae*) is one of the most destructive parasites of tea, attacking the stem as well as the younger foliage. The perfect stage of the fungus (*Glomerella*) [*cingulata*: ibid., xvi, p. 798] has been obtained on artificially inoculated leaves but not in culture. The same organism, together with *P. theicola* and *Pestalozzia theae* (either or both), is commonly isolated from scabbed foliage. Copper blight (*Guignardia camelliae*) [ibid., viii, p. 814] spreads rapidly in high temperatures. The fungus is a wound parasite and confines its attacks to the foliage. On the other hand, *Botryodiplodia theobromae* [ibid., xv, p. 748; xvi, p. 565], the agent of internal root disease, is a vigorous parasite capable

of attacking plants from the soil, through injuries to the aerial parts and through pruning wounds, pruned bushes inoculated by spraying with a spore suspension being killed within six to eight weeks. *Hendersonia theicola* is the cause of a bark disease of minor importance, characterized by a blackish discoloration and roughening of the stems. The light brown, triseptate, narrow oval or subcylindrical spores measure 10 to 13 by 3·5 to 4·5 μ and may extrude germ tubes from any of their cells. *Cephaleuros mycoidea* [ibid., ix, p. 746], though less common in north-west than in north-east India, has been observed on tea plants in the Baijnath Paprola district.

The inoculation experiments undertaken with all the organisms except the two last named gave positive results under controlled conditions.

[Tunstall (A. C.).] **Mycological.**—*Rep. mycol., bot., bact. Br. Indian Tea Ass., 1936*, pp. 1–9, 1937.

Further field spraying tests against tea black rot [*Corticium invisum* and *C. theae*: *R.A.M.*, xv, p. 748] in Assam and the Surma Valley showed that many of the untreated bushes that were infected in July, August, and September appeared to have recovered by November. Applications of Burgundy mixture and lime-sulphur to the pruned bushes during the cold weather had no appreciable effect on the reappearance of infection which usually occurred on the same bushes in the next rainy season, but applications during the rainy season had a significant effect on the disease. Bushes sprayed in July, 1935, with 1, 2, and 4 per cent. Burgundy mixture showed, respectively, a year later only 14, 14, and 11 per cent. infection as against 29 per cent. infection for those not sprayed. Lime-sulphur was found to be an excellent but only temporary palliative. In an Assam garden where only the infected bushes were sprayed with 1 per cent. Burgundy mixture, and those that revived were treated a second, and in some cases a third time, infection in the middle of October amounted to only 2·2 per cent., as against 23 per cent. for the untreated controls, while at the end of September bushes in another garden sprayed with home-made lime-sulphur and 1 per cent. Burgundy mixture showed, respectively, 37·6 and 7·8 per cent. infection, as against 70·8 per cent. for the untreated controls.

In a properly designed experiment, carried out in two gardens in July by a scientific officer, bushes sprayed with home-made and commercial lime-sulphur, 1 per cent. Burgundy mixture, and copper lime dust showed, respectively (averages for both gardens in October), 9·3, 7·6, 2·1, and 3·6 per cent. infection, as against 13 per cent. for the unsprayed controls. From the year's experiments it is concluded that the application of 1 per cent. Burgundy mixture during the picking season only to bushes found to be infected, as and when observed, is effective.

Considerable decay of the branches of tea bushes still occurs in spite of improved pruning and picking methods, necessitating direct methods of prevention and cure. In experiments on the protection of wounds from infection 60 per cent. bitumen in a mixture of kerosene (35 parts) and rosin-turpentine (5 parts) gave a good coating that can be applied with a thick brush.

YOUDEN (W. J.). **Use of incomplete block replications in estimating Tobacco-mosaic virus.**—*Contr. Boyce Thompson Inst.*, ix, 1, pp. 41–48, 1 fig., 1937.

The author presents a modification of the method of incomplete blocks described by Yates (*J. agric. Sci.*, xxvi, pp. 424–455, 1936) applicable to the estimation of the infectivity of virus preparations. The method permits the construction of complete blocks of replicates without sacrificing the advantage of incomplete blocks. The application of the method is illustrated in the estimation of the infective power of crystalline preparations of tobacco mosaic virus on plants of *Nicotiana glutinosa*, full data on which, and the requisite computations for the application of the analysis of variance to the data, are given. The standard deviation of a single leaf is nearly 40 per cent. of the average leaf count and affords some indication of the difficulties attending determinations of infectivity.

YOUDEN (W. J.). **Dilution curve of Tobacco-mosaic virus.**—*Contr. Boyce Thompson Inst.*, ix, pp. 49–58, 2 figs., 2 graphs, 1937.

Using the method of incomplete blocks [see preceding abstract] the author investigated the effect of dilution on the infectivity of tobacco mosaic virus protein, prepared according to Stanley's method (omitting treatment with lead subacetate), some crystals isolated by Dr. Stanley also being used. Data for 20 dilution series of tobacco mosaic virus protein are given. The results showed that at concentrations near 0·1 mg. per c.c. the virus protein may be diluted without a corresponding decrease in the number of lesions produced on the leaves of *Nicotiana glutinosa*, while there was considerable evidence that an increase of infectivity may occur after moderate dilution.

The comparison of solutions differing but little in concentration was made possible by use of the method of incomplete blocks.

MATSUMOTO (T.). **A further note on the serological studies of the Tobacco mosaic bearing malformed flowers.**—Reprinted from *Agric. & Hort.* [*Japan*], xii, 7, 5 pp., 2 figs., 1937. [Japanese, with English summary.]

In further investigations on the virus complex (tobacco mosaic + potato mosaic) causing a malformation of tobacco flowers [*R.A.M.*, xv, p. 610] the author separated the common tobacco mosaic virus from the virus complex, without impairing the infectivity of the former, by the following method. Anti-potato mosaic serum was added to diseased plant juice (1 : 3) until the concentration reached was from 1 : 10 to 1 : 240; the juice and serum was held for 2 hours at 37° C., placed overnight in a cold room, and next morning centrifuged for 30 minutes, the supernatant liquids being inoculated into healthy tobacco plants. The evidence obtained indicated that at serum concentrations of 1 : 10, 1 : 30, and 1 : 60, the potato mosaic virus can be completely absorbed without reducing the infectivity of the common tobacco mosaic virus, though at a concentration of 1 : 10 some of the inoculated plants remained unaffected. At dilutions of 1 : 120 and 1 : 240 the potato mosaic virus was not completely absorbed, and the

juice was still able to produce the composite disease. To separate the active common tobacco mosaic virus from the virus complex in question use should be made of a serum dilution of 1 : 30 and 1 : 60.

PAL (B. P.) & TANDON (R. N.). **Types of Tobacco leaf curl in Northern India.**—*Indian J. agric. Sci.*, vii, 3, pp. 363–393, 10 pl., 1 fig., 2 diags., 2 graphs, 1937.

Five types of tobacco leaf curl [*R.A.M.*, xvi, p. 414], A, B, C, D, and X, were differentiated in the course of the writers' comprehensive studies on this disease in Northern India, where it probably constitutes the most serious obstacle to successful cultivation, being present to the extent of 5 to 10 per cent. in normal years and virtually destroying the crop in an epidemic season such as that of 1934–5. Most of the observations were made on the Pusa H 142 variety. Weekly counts of diseased plants showed the maximum rate of spread to occur at planting-out time towards the end of October and early November, with further heavy increases during the second half of November and the beginning of December, followed by a decline until infection ceased in the second week of January, to be succeeded, however, by another definite rise in March. In 1935–6 the seed was sown in two lots, one in June (of H 142 variety) and the other (comprising H 142 and 177, Adcock, Harrison's Special, and Cash) at the normal time in August. The incidence of leaf curl in the former was about 63 per cent. more than in the latter, suggesting that monsoon conditions favour the activity of the insect vector of the disease [see next abstract]. Leaf curl was extremely rare in the seed-beds, the bulk of infection occurring after transplanting.

All five types of the disorder are marked by general stunting of the plants and reduction of the leaf area, curling of part or all of the leaf blade, vein-banding or thickening and greening of the veins in some or all of the leaves, condensation of the inflorescence with thickening and greening of the veins of the calyx and ovary wall, and transmissibility by grafting, but not by means of infected juice or through the seed. Types A and B are further characterized by profuse greening, enations, and a striking reduction of stature; in the case of A the leaves are small, much curled and thickened, rugose, brittle, and dark green, whereas in B they are larger, only slightly curled, wrinkled, and pale yellowish-green with no thickening or brittleness. Types C and D do not cause such severe stunting as the foregoing and enations are absent; both produce vein-clearing, which is more intense in C than in D and usually accompanied in the former by a few green 'stitches' in the older leaves. The features of type X are very variable, suggesting a mixture of the other forms described, and it was, in fact, synthetically induced in grafting tests with several combinations of pairs of A, B, C, and D. A and B were shown by grafting experiments to be readily separable from C and D by the symptoms developing on *Nicotiana glutinosa*, *Solanum nigrum*, and *Petunia* sp., while A is distinguishable from B, and C from D by the reactions of *N. rustica*.

Discussing the problem of control, the need for further knowledge concerning the alternate hosts of the virus is emphasized. At Pusa, symptoms strongly reminiscent of leaf curl have been observed on

Zinnia elegans, *P.* sp., *Althaea rosea*, *Hibiscus rosa-sinensis*, *Crotalaria juncea*, and *Scoparia dulcis*. In the meantime the roguing of diseased plants immediately following detection and their replacement by healthy ones is recommended. In 1934–5 there was about 19 per cent. less infection in the plots so treated than in the controls. Nursery-beds may possibly be protected from contamination by the insect vector by means of spraying or similar measures, but the most effective method of combating the disease consists in the development of resistant varieties. So far, however, none of those extensively tested at Pusa has shown any marked degree of resistance, but no infection has been observed on *N. plumbaginifolia*, growing as a common weed, which is presumably either resistant or a 'carrier'.

Pruthi (H. S.) & Samuel (C. K.). **Entomological investigations on the leaf-curl disease of Tobacco in North Bihar. I. Transmission experiments with some suspected insect vectors. II. An alternative host of the virus and the insect transmitter.**—*Indian J. agric. Sci.*, vii, 4, pp. 659–670, 3 pl., 1937.

Negative results were given in 1934–5 by all attempts to transmit four types of tobacco leaf curl (A, B, C, and X) [see preceding abstract] from diseased to healthy H 142 plants with the aid of the Capsid bug, *Cyrtopeltis* (*Gallobelicus*) *crassicornis* Dist., but whiteflies (*Bemisia gossypiperda*) conveyed the typical symptoms of the disorder from infected sann-hemp [*Crotalaria juncea*] to sound tobacco plants. The same insect, or a closely related species, is known to transmit leaf curl in Africa [*R.A.M.*, xv, p. 425] and the Dutch East Indies [ibid., xiii, p. 806], so the present observations are of considerable interest in connexion with the possible identity of the Indian form of the disease with that occurring elsewhere.

Hill (A. V.). **Yellow dwarf of Tobacco in Australia. I. Symptoms.**—*J. Coun. sci. industr. Res. Aust.*, x, 3, pp. 228–230, 1937.

Heavy losses are caused in some years in Victoria, New South Wales, South Australia, and southern Queensland by a dwarfing or stunting of tobacco, for which the name 'yellow dwarf' is recommended. The disease usually begins to appear a few weeks after transplanting and affected plants do not recover. In the 1935–6 season, 38 per cent. of the plants in experimental beds at Myrtleford, Victoria, were affected, while at Pomonal, in the same State, the disease reduced the potential yield of the district by 50 per cent. The average reduction in yield caused by the disease in Victoria during the past seven years is conservatively estimated at 10 per cent. More loss is caused in Victoria and southern New South Wales than elsewhere, and the extent of infection in different years appears to be correlated with time of planting and the weather conditions prevailing after transplanting.

As a rule, the first symptom is a rolling under of the margins and a downward bending of the tips of the young apical leaves, which may be dark green and closely packed round the bud; later, the ventral surface appears to be ribbed. Diseased plants are dwarfed, yellowish, and grow very slowly. They usually have a normal number of leaves, but the

stem is often only one-third of the normal length. The leaves are small, and unsuitable for commercial use. The flowers and capsules are normal but few in number. Flowering is contemporaneous with that of healthy plants, but the leaves mature sooner, those on the lowest third of the plant often dying before the seed begins to ripen. The older leaves are rugose, thickened, and even savoy-like, and the margins and tips generally bend down. The roots are less extensive than is the case with healthy plants, and are slightly brown externally and in the phloem region. If suckers develop they are weakly, the young leaves (like those at the apex of the plant) being rolled and bent, and sometimes thick, rugose, and twisted. The symptoms reappear on the new growth in the next spring.

Experimental evidence indicated that the condition is transmissible by grafting and budding and appears to be due to a virus, which is probably insect-borne.

Vong (W. G.). **The entrance and migration of Bacterium solanacearum Smith in Tobacco plants.**—*Ann. phytopath. Soc. Japan*, vii, 1, pp. 14–23, 1 pl., 5 figs., 1 graph, 1937.

Inoculations with potato agar or decoction cultures of *Bacterium solanacearum* on tobacco [*R.A.M.*, xvi, p. 780] stems, root, and leaves were successful only through wounds, and failed when applied to the stomata or water pores. In the case of the stigmas, however, previous injury was unnecessary. The organism assumed a virulent form in milk cultures and was able to attack the unwounded roots [cf. ibid., vii, p. 122]. In young stems and leaves the bacteria first occupied the xylem tubes, whence they migrated to the surrounding tissues, causing extensive disintegration. Bacterial cavities were frequently observed in the stem pith and cortex. The bacteria proceed somewhat more rapidly downwards than upwards in the xylem tubes: 24 hours after the inoculation of young stems at 25° C. the rates of movement downwards and upwards were 0·2692 and 0·2586 mm. per hour, respectively. The minimum, optimum, and maximum temperatures for migration of *Bact. solanacearum* were found to be 15°, 32°, and 40°, respectively.

Miller (P. R.). **January temperatures in relation to the distribution and severity of downy mildew of Tobacco.**—*Plant Dis. Reptr*, xxi, 14, pp. 260–266, 5 graphs, 5 maps, 1937. [Mimeographed.]

Downy mildew of tobacco [*Peronospora tabacina*: *R.A.M.*, xvi, p. 641] is stated to have been more widespread and destructive in the United States in 1937, especially in Georgia, North and South Carolina, and parts of Virginia, than at any time since its first appearance in 1921. From a survey of 2,000 plant beds it was evident that the extent of mildew damage in a given locality was closely correlated with the earliness of the first signs of infection in the district under observation. The date of appearance of the disease and the resultant injury were also correlated with mean temperatures approaching 62° F. in January, the effect of which, however, may not be fully expressed unless subsequent conditions also conduce to infection. Further observations are necessary, however, to determine the reliability of this method of forecasting future possibilities of damage from downy mildew.

SIMMONDS (J. H.). **The treatment of Tobacco seed-bed covers to prolong their useful life.**—*Qd agric. J.*, xlviii, 2, pp. 112–116, 1937.

In tests with 14 different substances for the prevention of the deterioration and moulding of calico covers used for covering tobacco seed-beds when undergoing treatment with benzol against downy mildew [*Peronospora tabacina*: *R.A.M.*, xvi, p. 284], it was found that the only dressings satisfactory in all respects were alum and lead acetate, and shirlan. The first is the cheaper method, but necessitates immersion of the calico in a solution of alum (1 lb. in 5 galls.) for one day and then in a solution of lead acetate (½ lb. in 5 gall.) for 5 to 6 hours; ¼ lb. of glue size or gelatine may be added to the lead acetate solution as a waterproofing agent. In the shirlan treatment the calico is soaked and kneaded for about half an hour in a mixture made by dissolving ½ lb. shirlan AG in 5 galls. of water. It may be necessary to repeat either treatment each season to make up for the leaching effects of rain.

MILBRATH (J. A.). **An indication of seed transmission of mosaic virus in Tomato seed.**—*Phytopathology*, xxvii, 8, pp. 868-869, 1937.

Four out of 25 Indian Canner tomato seedlings raised from seed planted on 1st November, 1935, collected a month earlier from a mosaic-infested site in Oregon developed symptoms of mosaic, two months later 3 out of 25 from the same source became similarly affected, and after a further six months 5 out of a batch of 677 plants of the same origin likewise contracted infection [*R.A.M.*, xvi, p. 842]. At the close of the 1936 season 11 out of 168 plants grown from seed collected three weeks earlier from an infected plot also developed mosaic, the tendency to the transmission of which would appear from the figures cited here to decline with the age of the seed.

AINSWORTH (G. C.). **'Enation mosaic' of Tomato caused by a virus of the Tobacco virus 1 type.**—*Ann. appl. Biol.*, xxiv, 3, pp. 545–556, 2 pl., 1 fig., 1937.

This is a full account of the author's investigations on the strain of tobacco virus 1 causing 'enation mosaic' in tomato, a preliminary note on which has been noticed from another source. [*R.A.M.*, xv, p. 672]. In addition to the information already given, it is stated that in tomato mechanical inoculation by any of the usual methods invariably results in 100 per cent. infection, the incubation period during spring and summer lasting about seven days. Most of the leaves formed after infection exhibit malformations comprising, at one time or another, almost every type of tomato leaf distortion previously described, and may also produce leafy outgrowths from their under side; in their early development and anatomical structure these enations have been found not to differ essentially from those described by Jensen in *Nicotiana paniculata* and *N. tomentosa* [ibid., xii, p. 538]. Less severely distorted leaves show a mottling of light and dark green indistinguishable from that of typical mosaic. In winter the incubation period of enation mosaic is about three weeks and the condition of the infected plants is similar to that in ordinary tomato mosaic. Reduction of daylight illumination of plants inoculated in April and May to eight hours per day (the approximate

length of a winter day) increased the incubation period from seven days in the controls to ten days. It had, however, a comparatively slight effect on the type of symptoms produced, since enation mosaic was readily distinguishable from ordinary mosaic by severe leaf distortion, although no enations developed. In a second series in May and June, in which the daily illumination of the inoculated plants was reduced to five hours, the plants grew very slowly and the first definite symptoms, a narrowing of the leaves, appeared after twenty days; the symptoms of mosaic and enation mosaic were very similar, the only difference being that the plants inoculated with enation mosaic were very slightly more stunted than those affected with ordinary mosaic. This is considered to indicate that the variation in symptoms is not a photoperiodic effect but is related to the actual rate of growth of the plants. In its action on White Burley tobacco the enation mosaic strain differs from tobacco virus 1 in that it produces necrotic local lesions on the inoculated leaves in three or four days, while tobacco virus 1 does not, and in that on the average only about 50 per cent. of the smaller White Burley plants inoculated with the former develop systemic symptoms, while with the latter it is very unusual for systemic infection not to occur.

In a discussion of the various types of tomato leaf malformations hitherto described, it is pointed out that the appearance of a single leaf may not be sufficient to diagnose the cause of the distortion. It is possible to distinguish several types of malformation according to the causal viruses, but the symptoms overlap to such an extent as to render the different diseases at times indistinguishable. The leaf malformation caused by tobacco virus 1, although of infrequent occurrence when growing conditions are favourable, may at other times, and especially when very young plants are inoculated, be so severe as to result in typical fern leaf. Another type is the fern leaf caused by cucumber virus 1 [ibid., ix, p. 418], which is typically more severe than that of ordinary mosaic and develops independently of the season under average greenhouse conditions. In a letter to the author, Chamberlain informed him that recent investigations have shown that tomato narrow leaf [ibid., xiv, p. 262] is caused by cucumber mosaic virus (cucumber virus 1 type). A third type is malformation caused by enation mosaic, the most unusual character of which is that although the causal virus is allied to tobacco virus 1, distortion is much more severe in summer than in winter.

A comparative study of tomato fern leaf material sent in by Rischkow [Ryjkoff] from Russia [ibid., xiii, p. 808; xiv, p. 130] showed that the virus involved in this condition is identical in its physical properties with standard tobacco mosaic, with which it also agreed by invariably causing systemic chlorosis in White Burley tobacco without the production of local lesions. In winter, severe distortion was produced in tomato, greater than the average with ordinary mosaic, but varying somewhat in degree in individual plants. No distortion occurred in spring and summer. Tobacco plants also were severely malformed in winter and very much less so in summer. These results show that Ryjkoff's virus is a type of tobacco virus 1, very similar to the standard virus and certainly distinct from enation mosaic virus.

CHAMBERLAIN (E. E.), BRIEN (R. M.), DALLAS (W. K.), & TAYLOR (E. T.). **Experiments on the control of Tomato leaf-mould.**—*N.Z.J. Agric.*, lv, 2, pp. 82–88, 1 fig., 1937.

A brief, tabulated account is given of experiments from 1934 to 1936, inclusive, on the control of *Cladosporium fulvum* [*R.A.M.*, xvi, p. 571] on tomatoes in commercial greenhouses at Wellington, New Zealand, the results of which showed that under conditions (high atmospheric humidity and lack of sufficient ventilation) favouring the development of the disease none of the liquid or dust fungicides tested gave complete control. The best and most consistent results were obtained with 0·3 per cent. shirlan A.G. spray, but lime-sulphur plus agral, lime-sulphur plus colloidal sulphur, and lime-sulphur alone were efficient enough to warrant their use. Gas-sulphur alone, having a particle size ranging from 2 to 10 μ, either as dust or spray, caused foliage injury under the conditions of the tests.

BLOOD (H. L.). **A possible acid seed soak for the control of bacterial canker of the Tomato.**—*Science*, N.S., lxxxvi, 2226, pp. 199–200, 1937.

Previous experiments having shown that bacterial canker of tomato (*Aplanobacter michiganense*) is controllable by fermenting the fruit pulp prior to seed extraction [*R.A.M.*, xiii, p. 478 and next abstract], analytical studies were made to ascertain the properties responsible for the toxicity of the fermented juices to the organism and the possibility of their practical application. The acids most abundantly produced during fermentation were found to be acetic and lactic, 0·35 to 0·58 per cent. of the former and 0·45 to 0·72 per cent. of the latter usually being present after 96 hours. A preliminary test of the efficacy of those acids as seed soaks for the control of *A. michiganense* was accordingly made, aliquot parts of seed extracted from diseased plants being immersed for 3, 6, 12, 24, 48, or 96 hours in 0·15, 0·3, or 0·6 per cent. acetic acid, in 0·3, 0·6, or 1·2 per cent. lactic acid, or in combinations of the respective concentrations of the two acids for the same periods. Corresponding lots of seed were immersed for 21½ hours in copper sulphate (1 lb. per 8 galls. water), for ten minutes in mercuric chloride (1 in 1,000), and for one hour in water heated to 54° C. A portion of the pulp of the same infected fruit was allowed to ferment for 96 hours before seed extraction. None of the treatments adversely affected germination. The following percentages of canker were recorded in field plots planted with seed from each treatment in 1936; untreated, immediate extraction 81·28, acetic acid soaks (all treatments) 0·08, combined acetic and lactic acids 0·225, lactic acid, 0·62, copper sulphate 6·22, mercuric chloride 6·19, hot water 7·73, and 96 hours' fermentation 0·188. In the combined acetic and lactic acid treatment, the maximum incidence of canker developed from seed lots treated with the lower concentrations for shorter periods. No infection occurred in any of the 1,147 plants grown from seed treated with a combination of 0·6 per cent. acetic and 1·2 per cent. lactic acid for any period. Further studies to establish the limits of concentration and effective schedules for the treatment, using acetic acid alone or in combination with lactic acid, are in progress.

ORTH (H.). **Untersuchungen über die Biologie und Bekämpfung des Erregers der Bakterienwelke der Tomaten (Bact. michiganense E.F.S.).** [Investigations on the biology and control of the agent of bacterial wilt of Tomatoes (*Bact. michiganense* E.F.S.).]—*Zbl. Bakt.*, Abt. 2, xcvi, 20–23, pp. 376–402, 7 figs., 2 graphs, 1937.

No essential differences in growth habit on 13 appropriate standard media were detected between 13 strains of *Bacterium* [*Aplanobacter*] *michiganense* from Germany [*R.A.M.*, xvi, p. 781] and one from England, but certain strains produced cells of abnormal shape, the lowered virulence of which is suggestive of degeneration. Drastic modifications in the cultural conditions induced varying degrees of teratology in the different strains, relative immutability being correlated with pronounced virulence.

A. michiganense is definitely a wound parasite and failed to attack uninjured roots, leaves, and fruits under experimental conditions. Even the liability of wounded organs to infection rapidly diminishes with progressive cicatrization. Wounded roots were more accessible to infection in sandy soils than in those well provided with humus; in the field destructive attacks are mainly confined to the lighter types of soil. Primary infection by *A. michiganense* takes place through the soil or diseased seed; the agency of the latter, however, seems to be largely indirect and consists in the infestation of the soil by the decomposing seed, leading ultimately to seedling infection. Secondary infection in the field is mainly due to the practice of cutting off the young shoots or nipping them with the fingernail; both knives and hands should therefore be disinfected in 0·1 per cent. mercuric chloride prior to these operations, the same solution being applicable also to the propagating soil and cuttings. Ten days' fermentation of the fruits in the course of seed preparation killed the organism [see preceding abstract], but the hot-water treatment injured the seeds at temperatures over 50° C.

The so-called 'bush' tomatoes, commercially known as 'Immune', 'Resista', or 'Fortschritt', are not as a rule subjected to the above-mentioned pruning process and thus suffer little from bacterial wilt in the field; their freedom, however, is entirely due to the absence of channels of entry for the pathogen since they readily contract the disease through wounds. Five of the commercial varieties, besides Resista, tested in the greenhouse showed a fair degree of resistance, namely, Lieby's Export, Magnum Bonum, Pierette, Protection, and Vesuvius; these are undergoing further trials in infested soil. Of the four wild forms of the tomato—*Solanum racemigerum*, *S. racemiflorum*, *S. humboldtii*, and *S. pruniforme*—similarly tested, the two first-named proved highly resistant to *A. michiganense*.

Zanzibar Protectorate. A Decree to make better provision for the prevention of the introduction and spread of disease destructive to plants. No. 9 of 1937.—6 pp., 1937.

This is the full text of the Plant Protection Decree, 1937 (12th June), providing for the exclusion from the Zanzibar Protectorate of all plant material liable to act as a source of infestation by diseases or pests by the usual means of inspection, treatment, quarantine, control of imports and exports, and other regulations calculated to serve the purpose in view [*R.A.M.*, ii, p. 480].